MORPHOTAXONOMY OF PISCIAN CESTODES AND ECOLOGICAL OBSERVATIONS OF *MASTACEMBELUS ARMATUS* (LACEPEDE) IN RELATION TO PARASITIC INFESTATION

A THESIS

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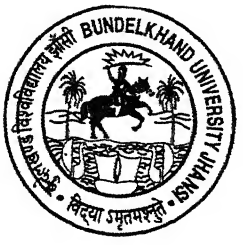

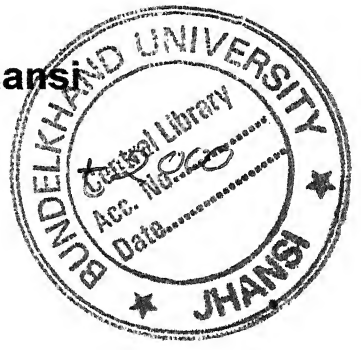

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This is to certify that the thesis entitled '**Morphotaxonomy of piscian cestodes and ecological observations of *Mastacembelus armatus* (Lacepede) in ralation to parasitic infestation**' embodies the original research work of Mr. Reetesh Kuamr Khare.

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Dedicated to
my beloved country

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Part-A

INTRODUCTION

Most of the fresh water fishes constitute highly nutritive food for human beings. Some of them are considered as delicacies. These edible fishes are known to harbour a number of helminth parasites Viz. trematodes, cestodes, nematodes and acanthocephala, which cause deterioration in their health, hence their nutritive and market value is affected. The government of India is making all efforts to increase the yield of disease free fishes.

The curiosity of the author to know about the helminth parasites found in such fishes lead him to undertake the present project. In the present thesis the author has restricted himself to the nature of infection of cestode parasites only.

Cestodes are mainly endoparasites of different parts of alimentary canal of their hosts Viz. stomach, upper intestine, middle intestine and lower intestine. The adult or larval forms or both may be pathogenic to their hosts. With a view to know the nature and extent of cestodes infection, regular studies were under taken to record the nature of parasitism in fresh water fish, *Mastacembelus armatus* (Lacepede) for two successive years. To have the idea of the state of infection in some fresh water fishes the survey was conducted in different parts of district Jhansi (U.P.) and Tikamgarh (M.P.) India.

The present thesis entitled 'Morphotaxonomy of piscian cestodes and ecological observations of *Mastacembelus armatus* (Lacepede) in relation to parasitic infestation' deals with some of the interesting cestodes obtained during the survey which include the description of eight new genera, three new subgenera and seven new species.

The new genera, new subgenera and new species belong to the families, Lytocestidae and Capingentidae of the order Caryophyllidea and the families Ptychobothriidae, Philobythiidae and Parabothriocephalidae of the order Pseudophyllidea.

A brief review relating to the new genera, new subgenera and new species described in the thesis are given below :-

The author in the present work divided the genus, *Bovienia* Fuhrmann, 1931 of the family Lytocestidae Hunter, 1927 into two new subgenera on the basis of shape of the ovary Viz. *Bovienia* (*Bovienia*) n. subg. and *Bovienia (Inverta)* n. subg. The present new subgenus and its type species *Bovienia (Inverta) singhi* n. subg., n. sp. is reported first time from whole world.

The new species, *Pseudoclariasis jadhavi* n.sp. belong to the family Capingentidae Hunter, 1930. So far only one species has been reported from the genus, *Pseudoclariasis* Pathak, 2002 from the Indian subcontinent. The present new species is the second from the Indian subcontinent.

The new genus, *Pseudoauricularia* n.g. represents the family Capingentidae Hunter, 1930 of the order Caryophyllidea Beneden in Carus, 1863. So far only sixteen genera have been reported from the family Capingentidae Hunter, 1930 from the whole world. Out of them twelve genera have been reported from the Oriental region and Indian subcontinent. The present new genus is thirteenth from the Oriental region and Indian subcontinent.

The new genus, *Pseudounevenata* n.g. represents the family Capingentidae Hunter, 1930 of the order Caryophyllidea Beneden in Carus, 1863. So far only sixteen genera have been reported in the

family from the whole world. Out of them twelve genera have been reported from the Oriental region and Indian subcontinent. The present new genus is fourteenth from the Oriental region and Indian subcontinent.

The new species, *Pseudobilobulata malhotrai* n. sp. belong to the family Capingentidae Hunter, 1930 of the order Caryophyllidea Beneden in Carus, 1863. So far only one species has been reported from the genus *Pseudobilobulata* Srivastav and Lohia, 2002 from the Indian subcontinent. The present species *Pseudobilobulata malhotrai* n. sp. is the second from the Indian subcontinent.

The new genus, *Pseudoheteroinverta* Srivastav and Khare, 2005 represents the family Capingentidae Hunter, 1930 of the order Caryophyllidea Benden in Carus, 1863. This new form has been erected as a new genus from whole world.

The new genus, *Sukhpatae* n.g. represents the family Capingentidae Hunter, 1930 of the order Caryophyllidea Beneden in Carus, 1863. So far only sixteen genera have been reported in the family from the whole world. Out of them twelve genera have been reported from the Oriental region and Indian subcontinent. The present new genus is the fifteenth from the Oriental region and Indian subcontinent.

The new genus, *Sudhaena* n.g. represents the family Capingentidae Hunter, 1930 of the order Caryophyllidea Beneden in Carus, 1863. So far only sixteen genera have been reported in the family from the whole world. Out of them twelve genera have been reported from the Oriental region and Indian subcontinent. The

present new form *Sudhaena khurdensis* n.g. n. sp. is the first report of the genus and its type species.

The new species, *Sudhaena udaypali* n.g. n. sp. belong to the family Capingentidae Hunter, 1930 of the order Caryophyllidea Benden in Carus, 1863. The present form is the second species of the genus *Sudhaena* n.g. from the Indian subcontinent.

The new species, *Pseudobatrachus madhyapradeshensis* n. sp. belong to the family Capingentidae Hunter, 1930 of the order Caryophyllidea Benden in Carus, 1863. So far only one species has been reported from the genus, *Pseudobatrachus* Pathak and Srivastav, 2005 from the Indian subcontinent. The present species is the second of the genus from the Indian subcontinent.

The new genus, *Heeradevina* Srivastav and Khare, 2005 represents the family Capingentidae Hunter, 1930 of the order Caryophyllidea Beneden in Carus, 1863. This form has been erected as a new genus from the Indian subcontinent.

The author in the present work divided the genus *Circumonchobothrium* Shinde, 1968 of the family Ptychobothriidae Luhe, 1902 into two new subgenera on the basis of vitellaria Viz. *Circumonchobothrium (Circumonchobothrium)* n. subg. and *Circumonchobothrium (Postovilata)* n. subg. The present new subgenus and its type species *Circumonchobothrium (Postovilata) betwaensis* n. subg., n. sp. is reported first time from the whole world.

The genus *Senga* Dollfus, 1934 of the family Ptychobothriidae Luhe, 1902 is currently represented by ten species from Oriental region and eight from Indian subcontinent. None is reported from

continental region. The present new species *Senga tictoi* n.sp. is the ninth from Indian subcontinent.

The genus, *Philobythos* has been erected by Campbell, 1977 in the family Philobythiidae. In the present work the author divided this genus into two new subgenera on the basis of rostellar hooks Viz. *Philobythos* (*Philobythos*) n. subg. and *Philobythos* (*Armata*) n. subg. The present new subgenus and its type species *Philobythos* (*Armata*) *gambhirii* n. subg., n. sp. is reported first time from the Indian subcontinent.

The new species, *Philobythos* (*Armata*) *bifurcatum* n. subg., n. sp. belong to the family Philobythiidae Campbell, 1977 of the order Pseudophyllidea Carus, 1863. The present form represents as the second species of the present new subgenus *Philobythos* (*Armata*) n. subg. from the Indian subcontinent.

The new genus, *Dactylobothrium* n.g. represents the family Parabothriocephalidae Yamaguti, 1959 of the order Pseudophyllidea Carus, 1863. So far only six genera have been reported in the family from the whole world. Out of them three genera have been reported from the Oriental region and Indian subcontinent. The present new genus is the forth from Oriental region and Indian subcontinent.

The new genus *Mastalobothrium* n.g. represents the family Parabothriocephalidae Yamaguti, 1959 of the order Pseudophyllidea Carus 1863. So far only six genera have been reported in the family from the whole world. Out of them three genera have been reported from Oriental region and Indian subcontinent. The present new genus is the fifth from the Oriental region and Indian subcontinent.

The new species *Neobothriocephalus sharmai* n.sp. belong to the family Parabothriocephalidae Yamaguti, 1959 of the order Pseudophyllidea Carus, 1863. So far only one species has been reported from the genus *Neobothriocephalus* Mateo *et* Bullock, 1966 from the whole world. The present new species is reported first time from India.

With a view to discover the Cestode host relationship, examination of the fresh water fish, *Mastacembelus armatus* (Lacepede) has been performed for two successive years. The prevalence, mean intensity and relative density of cestode infection has been worked out, in relation to the body weight, sex and cloacal temperature of the host.

HISTORICAL

Quite a number of workers have contributed the knowledge of Cestode Morphotaxonomy from freshwater fishes of Indian subcontinent.

Southwell, T. was the earliest and the pioneer worker in the field of cestode morphotaxonomy. Southwell recorded *Gangesia bengalensis* (1913) from India. He also published a classical volume on cestode parasites Viz. 'The Fauna of British India' (1930).

The important contribution of Woodland, W.N.F. comprise *Senga pycnomera* (1924), *Gangesia wallago* (1924) and *Gangesia macrones* (1924) from India.

Moghe, M.A. reported *Caryophyllaeus indicus* (1925) from India.

Verma, S.C. described *Gangesia agraensis* (1928) from India.

Mehra, H.R. contributed *Caryophyllaeus kashmiriensis* (1930) from India.

Dollfus, R. Ph. described *Senga besnardi* (1934) from India.

Singh, K.S. contributed *Gangesia lucknowia* (1948) from India and Pakistan.

Lynsdale, J.A. described *Lytocestus birmanicus* (1956) from Burna.

The important contribution of Johri, G.N. comprise *Senga lucknowensis* (1956) and *Hunteroides mystei* (1959) from India.

Gupta, S.P. desribed a number of known and unknown cestodes from India. His important contributions are *Lucknowia follilisi* (1961), *Capingentoides batrachii* (1961), *Pseudolytocestus clariae* (1961),

Pseudocaryophyllaeus indica (1961) and *Capingentoides hetropeneusti* (1980 with Sinha, N.).

Fernando, C.H. and Fernando, J.I. described *Polyonchobothrium parva* (1963) from Sri Lanka.

Murhar, B.M. described *Crescentovitus biloculus* (1963) from India.

The important contribution of Shinde, G.B. comprise *Circumonchobothrium ophiocephali* (1968), *Lytocestoides aurangabadensis* (1970), *Circumonchobothrium raoii* (1976 with Jadhav, B.V.), *Mastacembellophyllaeus nandensis* (1977 with Chincholikar, L.N.), *Circumonchobothrium khami* (1977), *Circumonchobothrim shindei* (1977 with Chincholikar, L.N.), *Mastacembellophyllaeus paithanensis* (1978 with Jadhav, B.V.), *Senga godavari* (1980 with Jadhav, B.V.) and *Senga khami* (1980 with Desmukh, R.A.) from India.

Rehana, R. and Bilqees, F.M. described *Gangesia sindensis* (1971) from Pakistan.

Verma, S.L. reported *Capingentoides indica* (1971) and *Capingentoides* singhia (1971) from India.

Pandey, K.C. described *Capingentoides moghei* (1973) from India.

Ramadevi, P. contributed *Lytocestus longicollis* (1973) and *Senga vishakhapatanamensis* (1973 with Rao, H.) from India.

Satpute, L.R. and Agrawal, S.M. described *Djombangia indica* (1974) and *Introvertus raipurensis* (1980) from India.

Singh S.S. reported *Lytocestus fossilis* (1975) from Nepal

The important contribution of Zaidi, D.A. and Khan, D. comprise *Bovienia ilishai* (1976) and *Senga taunsaensis* (1976) from Pakistan.

Chincholikar, L.N. and Shinde, G.B. described *Circumonchobothrium bagariusi* (1977) from India.

Sahay, S.N. and Sahay, U. described *Djombangia caballeroi* (1977) from India.

The important contribution of Malhotra, S.K. and Capoor, V.N. comprise *Tortocephalus songi* (1980), *Gangesia sanehensis* (1980) and *Gangesia mahamadabadensis* (1981 with Dixit S.) from India.

Gupta, V. described a number of known and unkonwn cestodes from India. His important contribution are *Psudocaryophyllaeus meckiewiczi* (1982 with parmar, S.), *Capingentoides fotedari* (1982 with parmar, S.), *Gangesia* (*Gangesia*) *indica* (1982 with Parmar S.) *Psudocaryophyllaeus ritai* (1983 with Singh, S.R.), *Senga indica* (1985 with Parmar, S.) and *Silurotaenia vachai* (1988 with Parmar, S.).

Agrawal, N. and Singh, H.S. described C*apingentoides gorekhnathai* (1985) from India.

The important contribution of Mathur, N. and Srivastav, A.K. Comprise *Nomimoscolex fossilis* (1992), *Pseudoadenoscolex fossilis* (1994), *Senga jhansiensis* (1994 with Daisy Rani), *Bilobulata georgievi* (1996), *Pseudolytocestus dayali* (1997), *Gangesia chauhanii* (2000) and *Nomimoscolex shrotrii* (2000) from India.

Srivastav, A.K. described *Gigantolina* (*Uniloculata*) *raebarelensis* (1993 with Mathur, N.), *Pseudobilobulata batrachus* (2002 with Lohia, S.), *Heeradevina baruasagarensis* (2005 with Khare, R.K.) and *Pseudoheteroinverta tikamgarhensis* (2005 with Khare, R.K.) from India.

Pandey, P.N., Mittal, N. and Singh, S.R. reported *Capingentoides vachai* (2000) and *Pseudolytocestus fossilisi* (2000) from India.

Lohia, S. and Srivastav, A.K. contributed *Jalpos pahujensis* (2000) and *Sukhobythos capoori* (2001) from India.

Pathak, A. and Srivastav, A.K. described *Pseudobatrachus chandrai* (2005) from India.

Besides the major contributions of the aforesaid workers a number of stray papers have been published by Verma, S.C. (1926), Moghe, M.A. (1926), Fotedar, D.N. (1958) Johri, G.N. (1959), Mackiewicz, J.S. and Murhar, B.M. (1972), Fotedar, D.N. (1974), Dhar, R.L. and Fotedar, D.N. (1979), Nama, H.S. (1979), Jadhav, B.V. and Shinde, G.B. (1981), Gupta, V. and Parmar, S. (1990) and Sathyanarayana, M.C. and Venkatachalam S. (1993).

Very scanty work has been done on ecology of helminth parasites. Mathur, N. (1992), Lohia, S. (2000) and Pathak, A. (2002) have tried to make relation of cestode parasites with the *Heteropneustes fossilis* (Bl.), *Channa punctatus* (Bl.) and *Rita rita* (Ham.) respectively.

Besides the major contribution of the aforesaid workers a number of stray papers on host parasites relationship have been published by Dogiel, V.A. (1961), Thomas, J.D. (1964), Kinsella, J.M. (1966), Kennedy, C.R. (1969), Chubb, J.C. (1977), Malhotra, S.K., Chauhan, R.S. and Capoor, V.C. (1980), Chauhan, R.S., Malhotra, S.K. and Capoor, V.N. (1981), Morgolis, L. (1982), Esch, G.W. (1983), Malhotra, S.K. and Chauhan, R.S. (1984), Abu, A. and Abu, T. *et al.* (1984), Amin, O.M. (1986), Kearn, G.C. (1986), Jha, A.N. and Sinha, P. (1990), Tochque, K. and Tinseley, R.C. (1991), Saberwal, A, Malhotra, S.K. and Capoor, V.N. (1992), Mathur, N. and Srivastav, A.K. (1994, 1998 & 1999), Pavanelli, G.C. and Takemoto, R.M. (2000), Oniye, S.J., Adebote, D.A. and Ayanda, O.I. (2004), Singh, O.V. and Malik, B.S. (2004), Klein, S.L. (2004), Singh, Abha Raj and Srivastav, A.K. (2006).

MATERIALS AND METHODS

For morphotaxonomical study of cestode parasites, the fishes were collected through different sources. The alimentary canal of the fishes were removed and cut open in normal saline water in troughs or petridishes. It was lightly shaken and its contents decanted several times. The intestine and its contents containing helminth parasites were examined thoroughly under a binocular microscope to ensure that none of the parasite is left behind. In some cases, the scolices of cestode parasites were deeply embedded, it was found necessary to take them out by scrapping the mucosa of the intestine with sharp scalpel or by releasing the scolices with a pair of needles or forceps. Later the portion of the mucosa attached to the cestode body was removed by shaking the body of cestode in normal saline water. The worms were stretched in luke warm water and in case of larger worms, by lifting them with the help of needles or forceps against the edges of petridishes repeatedly for several times and later on fixed in 5% formalin or in alcoholic Bouin's fluid. Worms fixed in Bouin's fluid were washed in water, treated with 50% and 70% alcohols and finally stored in 70% alcohol.

The whole mounts were stained in Mayer's haemalum and cleared in xylol. For sectioning, the material was cleared in xylol, embedded in histowax and cut at 0.008-0.01 m.m., stained with Delafield's haematoxyline and Eosin and Mounted in Canada balsam. Only camera lucida drawings were made. All the measurements have been given in millimeters unless otherwise stated. Averages taken on

the basis of the study of three to ten worms except in cases where still fewer worms were obtained.

During the course of study the total number of hosts thus examined were 536. The hosts examined belong to the 24 species of fishes.

For ecological study of host-parasite relationship, the fresh water fish, *Mastacembelus armatus* (Lacepede) was selected. The live fishes were obtained from Betwa river, district Jhansi (U.P) India through local fish catchers. A thorough study of ten fishes were examined in a month. This was continued for two successive years from July 2003 to June 2005.

Following steps were used for the study of host-parasite relationship :-

(i) Live fishes were weighed individually

(ii) Cloacal temperature of fishes were measured with the help of physical thermometer.

(iii) Live fishes were anesthetized with the help of chloroform.

(iv) Aneshthetized fishes were dissected quickly to find out their sex by locating testes for males and ovaries for females.

(v) The alimentary canals of hosts were removed and cut open in the normal saline water in petridishes.

(vi) All the four kinds of helminth parasites Viz. trematodes, cestodes, nematodes and acanthocephala were collected and counted separately in each infection.

(vii) The different helminth parasites were stored in 5% formalin in separate collecting bottles.

During the course of the ecological study of host-parasite relationship a total number of 240 *Mastacembelus armatus* (Lacepede) were examined and 103 of them were found infected with helminth parasites while 137 fishes were found negative for helminth infection. The total number of 642 helminth parasites were obtained which included 02 trematodes, 49 cestodes, 574 nematodes and 17 acanthocephala.

During the ecological studies prevalence, mean intensity and relative density of helminths infection were calculated on annual basis while prevalence, mean intensity and relative density of cestodes infection were calculated monthwise, seasonwise and on annual basis.

The definitions and formulae of prevalence, mean intensity and relative density given by Morgolis *et al*, 1982 were followed.

PREVALENCE : Number of individuals of a host species infected with a particular parasite species divided by number of hosts examined.

$$\text{Prevalence} = \frac{\text{Number of hosts infected}}{\text{Number of hosts examined}}$$

MEAN INTENSITY : Total number of individuals of a particular parasite species in a sample of a host species divided by number of infected individuals of host species in the sample.

$$\text{Mean intensity} = \frac{\text{Total number of parasites obtained}}{\text{Total number of hosts infected}}$$

RELATIVE DENSITY : Total number of individuals of a particular parasite species in a sample of host divided by total number of individuals of the host species.

$$\text{Relative density} = \frac{\text{Total number of parasites obtained}}{\text{Total number of hosts examined}}$$

Prevalence, mean intensity and relative density of cestode parasites were calculated in relation to the following parameters :-

(a) Body weight of the host

(b) Sex of the host

(c) Cloacal temperature of the host.

HOST PARASITE LIST

S. No.	Name of the host	Number of host examined	Number of host infected with cestodes	Name of cestodes obtained
1	*Amphipnous cuchia* (Ham.)	4	-	-
2	*Bagarius bagarius* (Ham.)	6	-	-
3	*Catla catla* (Ham.)	5	-	-
4	*Channa marulius* (Ham.)	8	-	-
5	*Channa punctatus* (Bl.)	20	5	*Dactylabothrium choprai* n.g., n. sp. *Neobothriocephalus sharmai* n.sp.
6	*Channa striatus* (Bl.)	24	5	*Philobythos* (*Armata*) *gambhirii* n. subg., n.sp. *Philobythos* (*Armata*) *bifurcatum* n. subg., n.sp.
7	*Clarias batrachus* (Linn.)	32	10	*Bovienia* (*Inverta*) *Singhi* n. subg., n.sp. *Pseudoclariasis jadhavi* n.sp. *Pseudoauricularia baruanalensis* n.g., n.sp. *Pseudounevenata teharkaensis* n.g., n.sp. *Pseudobilobulata malhotrai* n.sp. *Pseudobatrachus madhyapradeshensis* n.sp. *Heeradevina baruasagarensis* Srivastav and Khare, 2005
8	*Heteropneustes fossilis* (Bl.)	40	6	*Pseudoheteroinverta tikamgarhensis* Srivastav and Khare, 2005 *Sukhpatae prathvipurensis* n.g., n.sp. *Sudhaena khurdensis* n.g., n.sp. *Sudhaena udaypali* n.g., n.sp.
9	*Labeo calbasu* (Ham.)	3	-	-

Contd....

S. No.	Name of the host	Number of host examined	Number of host infected with cestodes	Name of cestodes obtained
10	*Labeo rohita* (Ham.)	2	-	-
11	*Mastacembelus armatus* (Lacepede)	240	31	*Circumonchobothrium* (*Postovilata*) *betwaensis* n.subg., n.sp. *Mastalobothrium agrawali* n.g., n.sp.
12	*Mastacembelus puncalus (Ham.)*	20	-	-
13	*Mystus seenghala* (Sykes)	18	-	-
14	*Mystus tengara* (Ham.)	4	-	-
15	*Mystus vittatus* (Bl.)	10	-	-
16	*Notopterus chitala* (Ham.)	8	-	-
17	*Notopterus notopterus* (Pallas)	10	-	-
18	*Ompok bimaculatus* (Bl.)	16	-	-
19	*Puntius conchorius* (Ham.)	5	-	-
20	*Puntius sarana* (Ham.)	2	-	-
21	*Puntius ticto* (Ham.)	17	5	*Senga tictoi* n.sp.
22	*Rita rita* (Ham.)	12	-	-
23	*Wallago attu* (Bl. & Schn.)	17	-	-
24	*Xenentodon cancila* (Ham.)	13	-	-

CLASSIFIED LIST OF THE CESTODE PARASITES

Class	:	Cestoidea (Cestoda) Rudolphi, 1809
Subclass	:	Eucestoda Southwell, 1930
Order	:	Caryophyllidea Beneden in Carus, 1863
Family	:	Lytocestidae Hunter, 1927
Genus	:	*Bovienia* Fuhrmann, 1931
Subgenus	:	*Bovienia*(*Inverta*) n. subg.
Species	:	*Bovienia* (*Inverta*) *singhi* n.subg.,n.sp.
Family	:	Capingentidae Hunter, 1930
Genus	:	*Pseudoclariasis* Pathak, 2002
Species	:	*Pseudoclariasis jadhavi* n.sp.
Genus	:	*Pseudoauricularia* n.g.
Species	:	*Pseudoauricularia baruanalensis* n.g., n.sp.
Genus	:	*Pseudounevenata* n.g.
Species	:	*Pseudounevenata teharkaensis* n.g., n.sp.
Genus	:	*Pseudobilobulata* Srivastav and Lohia, 2002
Species	:	*Pseudobilobulata malhotrai* n.sp.
Genus	:	*Pseudoheteroinverta* Srivastav and Khare, 2005
Species	:	*Pseudoheteroinverta tikamgarhensis* Srivastav and Khare, 2005

Genus	:	*Sukhpatae* n.g.
Species	:	*Sukhpatae prathvipurensis* n.g., n.sp.
Genus	:	*Sudhaena* n.g.
Species	:	*Sudhaena khurdensis* n.g., n. sp.
Species	:	*Sudhaena udaypali* n.g., n.sp.
Genus	:	*Pseudobatrachus* Pathak and Srivastav, 2005
Species	:	*Pseudobatrachus madhyapradeshensis* n. sp.
Genus	:	*Heeradevina* Srivastav and Khare, 2005
Species	:	*Heeradevina baruasagrensis* Srivastav and Khare, 2005
Order	:	Pseudophyllidea Carus, 1863
Family	:	Ptychobothriidae Luhe, 1902
Genus	:	*Circumonchobothrium* Shinde, 1968
Subgenus	:	*Circumonchobothrium (Postovilata)* n. subg.
Species	:	*Circumonchobothrium* (*Postovilata*) *betwaensis* n. subg., n. sp.
Genus	:	*Senga* Dollfus, 1934
Species	:	*Senga tictoi* n. sp.
Family	:	Philobythiidae Campbell, 1977
Genus	:	*Philobythos* Campbell, 1977
Subgenus	:	*Philobythos* (*Armata*) n.subg.

Species	:	*Philobythos* (*Armata*) *gambhirii* n. subg. n. sp.
Species	:	*Philobythos* (*Armata*) *bifurcatum* n. subg., n. sp.
Family	:	Parabothriocephalidae Yamaguti, 1959
Genus	:	*Dactylobothrium* n.g.
Species	:	*Dactylobothrium choprai* n.g., n. sp.
Genus	:	*Mastalobothrium* n.g.
Species	:	*Mastalobothrium agrawali* n.g., n. sp.
Genus	:	*Neobothriocepthalus* Mateo *et* Bullock, 1966
Species	:	*Neobothriocephalus sharmai* n. sp.

LIST OF ABBREVIATIONS

ACS	:	Accessory sucker
AD	:	Apical disc
APS	:	Apical sucker
Aug.	:	August
B	:	Bothrium
CP	:	Cirrus pouch
Dec.	:	December
E	:	Egg
EP	:	Excretory pore
ESV	:	External seminal vesicle
Feb.	:	February
GA	:	Genital atrium
IP	:	Immature proglottid
ISV	:	Internal seminal vesicle
Jan.	:	January
MD	:	Midduct
MG	:	Mehlis gland
N	:	Neck
Nov.	:	November
O	:	Ovary
Oct.	:	October
R	:	Rostellum
RH	:	Rostellar hooks
RS	:	Receptaculum seminis
SC	:	Scolex

Sept.	:	September
T	:	Testis
U	:	Uterus
UP	:	Uterine pore
V	:	Vagina
VD	:	Vas deferens
VF	:	Vitelline follicle
VG	:	Vitelline gland
VLEC	:	Ventral longitudinal excretory canal

Part-B

(1.1)
Bovienia (Inverta) singhi
n.subg., n.sp.

Order : Caryophyllidea Beneden in Carus, 1863

Family: Lytocestidae Hunter, 1927

Genus: *Bovienia* Fuhrmann, 1931

Subgenus: *Bovienia* (*Inverta*) n. subg.

Species : *Bovienia* (*Inverta*) *singhi* n. subg., n.sp.

***Bovienia (Inverta) singhi* n. subg., n. sp.** (Fig. 01)

Ten fishes, *Clarias batrachus* (Linn.) caught from Baruasagar, district Jhansi (U.P.) India, two were found infected with four alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to a new subgenus *Bovienia (Inverta)* n. subg. of the genus *Bovienia* Fuhrmann, 1931 of the family Lytocestidae Hunter, 1927; order Caryophyllidea Beneden in Carus, 1863.

SUBGENERIC DIAGNOSIS

Medium sized, unsegmented worms with simple, blunt, elleptical and undifferentiated scolex without any groove, cushion or spines. Neck very long. Well developed oval to round cirrus pouch with internal seminal vesicle. Vitellaria entirely cortical, reaches below the level of cirrus pouch. Postovarian vitellaria absent. Testes entirely medullary. External seminal vesicle and receptaculum seminis absent. Ovary inverted A- shaped, ovarian lobes partly cortical and partly medullary while isthmus entirely medullary. Uterus long, coiled, nonglandular and not extending anterior to cirrus pouch. Eggs oval to round and operculate. Parasites of fresh water fishes.

***Bovienia (Inverta) singhi* n. subg., n. sp.**

Medium sized and unsegmented cestodes measure 24.0-32.0 (28.0) in length and 0.882-0.987 (0.934) in width. Scolex simple, blunt, elleptical and undifferentiated from neck. Scolex measurers 0.753-0.853 X 0.228-0.278

(0.803 X 0.253). Scolex lacking any additional structures like groove, cushion or spines. Neck very long measures 6.028-6.564 X 0.131-0.162 (6.296 X 0.146).

Testes 40-80 in number, oval to round measure 0.087-0.137 X 0.114-0.162 (0.112 X 0.138), located in medullary region and located anterior to cirrus pouch. Vas deferens measures 0.014-0.026 (0.020)in diameter. Cirrus pouch median, oval to round measures 0.105-0.134 X 0. 205–0.255 (0.119 X 0.231). Internal seminal vesicle measures 0.056-0.078 X 0.062-0.089 (0.067 X 0.075). External seminal vesicle absent.

Female genitalia posteriorly situated. Ovary inverted A- shaped measures 1.288-1.654 X 0.582-0.712 (1.471 X 0.647), ovarian lobes partly cortical and partly medullary while ovarian isthmus entirely medullary.

Vitelline follicles entirely cortical and measure 0.053-0.089 X 0.059-0.099 (0.071 X 0.079), reaches below the level of cirrus pouch. Postovarian vitellaria and receptaculum seminis absent.

Uterus long, coiled and nonglandular measures 1.628-1.999 X 0.378-0.528 (1.813 X 0.453), not extending anterior to cirrus pouch. Male and female gonopores separately situated at the base of cirrus pouch.

Eggs oval to round, operculate measure 0.030 - 0.036 X 0.036-0.045 (0.033 X 0.040). Excretory pore measures 0.024-0.030 X 0.050-0.065 (0.027 X 0.057). Ventral longitudinal excretory canals measure 0.012-0.014 (0.013) in diameter.

DISCUSSION

The present form comes closer to the genus *Bovienia* Fuhrmann, 1931.

The present form differs from *Bovienia* Fuhrmann, 1931 in having inverted A- shaped ovary and absence of receptaculum seminis. In case of *Bovienia* Fuhrmann, 1931 ovary H-shaped while receptaculum seminis present (Table 01).

Thus the proposed new subgenus *Bovienia* (*Inverta*) n. subg. have two major differences from genus *Bovienia* Furhmann, 1931 of the family Lytocestidae Hunter, 1927; order Caryophyllidea Beneden in Carus, 1863.

Hence genus *Bovienia* is divided into two new subgenera Viz. *Bovienia (Bovienia)* n. subg. and *Bovienia (Inverta)* n. subg. on the basis of shape of the ovary.

In the light of above discussion the species *Bovienia* (*Inverta*) *singhi* n. subg., n. sp. may be provisionally accommodated in the proposed new subgenus.

The species is named after the eminent helminthologist Prof. H.S. Singh, C.C.S. University, Meerut (U.P.) India.

Host : *Clarias batrachus* (Linn.)

Habitat : Intestine

Locality : Baruasagar, district Jhansi (U.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

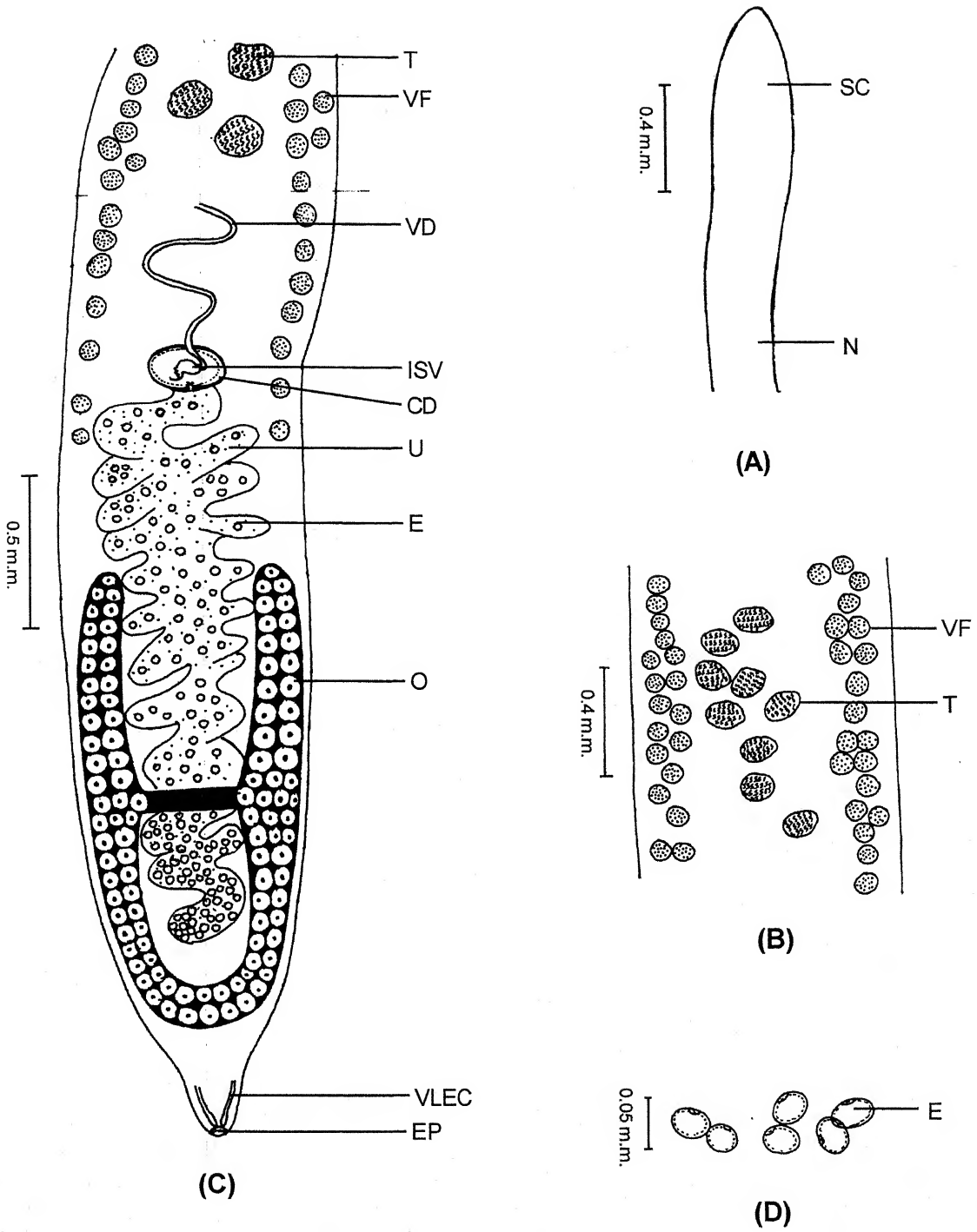


Fig. 01 : ***Bovienia (Inverta) singhi*** n.subg., n.sp., A-Scolex with neck (50X), B-Middle region of the body (50X), C- Posterior region of the body (50X), D-Eggs (225X)

TABLE 01 : Major differences between *Bovienia* Fuhrmann, 1931 and *Bovienia (Inverta)* n. subg.

S.No.	***Bovienia*** **Fuhrmann, 1931**	**Bovienia *(Inverta)*** **n. subg.**
1	H- shaped ovary	Inverted A- shaped Ovary
2	Receptaculum seminis present	Receptaculum Seminis absent

Key to the new subgenera of the genus *Bovienia* Fuhrmann, 1931 of the family Lytocestidae Hunter, 1927

1a. Ovary H-Shaped ..... *Bovienia (Bovienia).* n. subg.

1b. Ovary inverted A-shaped ..... *Bovienia (Inverta)* n. subg.

(2.1)
Pseudoclariasis jadhavi
n.sp.

Order : Caryophyllidea Beneden in Carus, 1863

Family : Capingentidae Hunter, 1930

Genus : *Pseudoclariasis* Pathak, 2002

Species : *Pseudoclariasis jadhavi* n. sp.

***Pseudoclariasis jadhavi* n. sp.** (Fig. 02)

Ten fishes, *Clarias batrachus* (Linn.) were caught from Baruasagar, district Jhansi (U.P.) India, three were found infected with four alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to the genus *Pseudoclariasis* Pathak, 2002 of the family Capingentidae Hunter, 1930; order Caryophyllidea Beneden in Carus, 1863.

Medium sized, unsegmented cestodes measure 8.0-12.0 (10.0) in length and 1.4 - 1.6 (1.5) in width. Scolex conical without any groove, cushion or spines and measures 0.852-1.025 X 0.812 - 0.925 (0.938 X 0.868). Neck absent.

Testes numerous, medullary and oval to round measure 0.058-0.068 X 0.105 - 0.149 (0.063 X 0.127), located anterior to cirrus pouch. Cirrus pouch oval to round, median measures 0.353-0.428 X 0.526 - 0.603 (0.390 X 0564). Internal and external seminal vesicles absent.

Female genitalia posteriorly situated. Ovary fan-shaped measures 0.376-0.427 X 0.903 - 0.988 (0.401 X 0.945), lateral lobes of ovary situated in cortex and medulla while isthmus in medullary region only.

Vitelline follicles partly cortical and partly medullary, measure 0.043 - 0.052 X 0.054 - 0.073 (0.047 X 0.063), extend below the level of cirrus pouch. Postovarian vitellaria and receptaculum seminis absent.

Uterus broad, coiled and nonglandular measures 1.015-1.178 X 0.828-0.972 (1.096 X 0.9). Male and female gonopores separately situated at

the base of cirrus pouch. Mehlis gland oval, median and postovarian measures 0.043-0.052 X 0.097-0.123 (0.047 X 0.11).

Eggs oval and nonoperculate measure 0.018-0.023 X 0.039-0.045 (0.020 X 0.042). Excretory pore measures 0.031-0.049 X 0.051-0.065 (0.04 X 0.058).

DISCUSSION

The present form comes closer to *Pseudoclariasis pandei* Pathak, 2002.

The present form differs from *Pseudoclariasis pandei* Pathak, 2002 in having larger and narrower worms, larger and broader scolex, smaller and narrower testes, larger and broader cirrus pouch, absence of internal seminal vesicle, smaller and narrower ovary, smaller and narrower vitellaria, smaller and narrower uterus, presence of mehlis gland and nonoperculate smaller eggs (Table 02).

In the light of above discussion the present form may be provisionally accommodated in the proposed new species.

The species is named after a great parasitologist Prof. V.B. Jadhav, Department of Zoology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (M.S.) India.

Host : *Clarias batrachus* (Linn.)

Habitat : Intestine

Locality : Baruasagar, district Jhansi (U.P.) India

Holotype : Parasitalogical laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

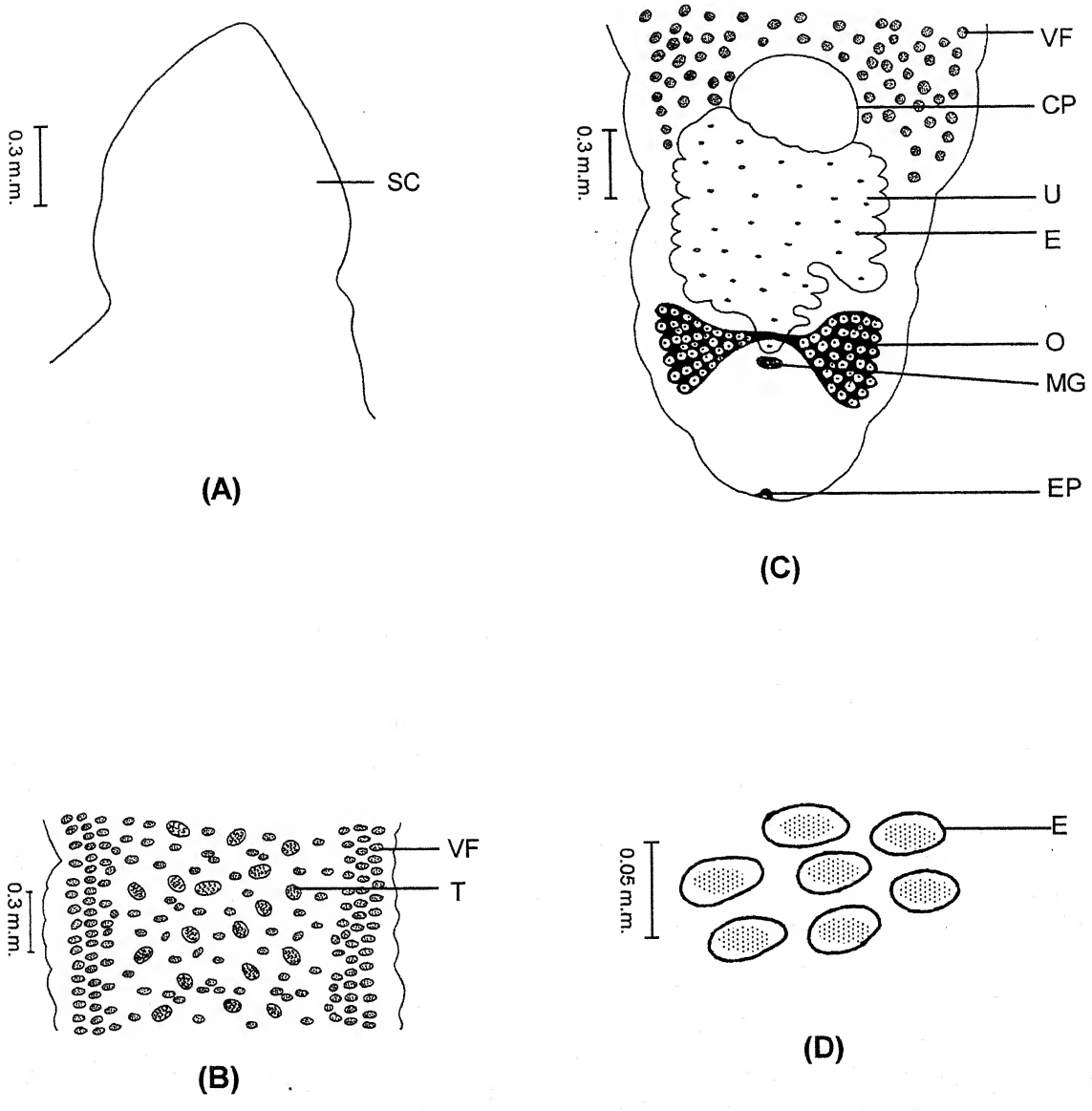


Fig. 02 : ***Pseudoclariasis jadhavi*** n.sp., A - Scolex (50X), B - Middle region of the body (50X), C-Posterior region of the body (50X), D-Eggs (225X)

TABLE 02 : Comparison of the characters of the species closer to *Pseudoclariasis jadhavi* n.sp.

S. No.	Characters	*Pseudoclariasis pandei* Pathak, 2002	*Pseudoclariasis jadhavi* n.sp.
1	Size of worms	6.0 - 13.0 X 0.2 - 0.256	8.0 - 12.0 X 1.4- 1.6
2	Scolex	0.4-0.484 X 0.414-0.5	0.852-1.025 X 0.812-0.925
3	Neck	Absent	Absent
4	Testes	0.128-0.191 X 0.1-0.242	0.058-0.068 X 0.105-0.149
5	Cirrus Pouch	0.2-0.3 X 0.3-0.370	0.353-0.428 X 0.526-0.603
6	Internal seminal vesicle	Present	Absent
7	External seminal vesicle	Absent	Absent
8	Ovary Shape Size	 Fan - Shaped 0.7-1.1 X 1.6-1.8	 Fan - shaped 0.376-0.427 X 0.903-0.988
9	Vitellaria	0.056-0.1 X 0.084-0.142	0.043-0.052 X 0.054-0.073
10	Uterus	2.6-2.9 X 1.3-1.6	1.015-1.178 X 0.828 - 0.972
11	Mehlis gland	Absent	Present
12	Receptaculum seminis	Absent	Absent
13	Eggs Type Size	 Operculate 0.037-0.05 X 0.06 - 0.09	 Nonoperculate 0.018 - 0.023 X 0.039 - 0.045

(2.2)
Pseudoauricularia baruanalensis
n.g., n.sp.

Order : Caryophyllidea Beneden in Carus, 1863

Family : Capingentidae Hunter, 1930

Genus : *Pseudoauricularia* n.g.

Species : *Pseudoauricularia baruanalensis* n. g., n. sp.

***Pseudoauricularia baruanalensis* n.g., n. sp.** (Fig. 03)

Ten fishes, *Clarias batrachus* (Linn.) caught from Baruanala at Baruasagar, district Jhansi (U.P.) India, two were found infected by six alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to a new genus, *pseudoauricularia* n.g. of the family Capingentidae Hunter, 1930; order Caryophyllidea Beneden in Carus, 1863.

GENERIC DIAGNOSIS

Medium sized, unsegmented cestodes with slightly pointed scolex without any groove, cushion or spines. Neck absent. Vitellaria partly cortical and partly medullary, reaches below the level of cirrus pouch. Postovarian vitellaria absent. Testes numerous, oval to round and medullary. Oval to round cirrus pouch. External and internal seminal vesicles absent. Ovary ear-shaped, ovarian lobes partly cortical and partly medullary while isthmus entirely medullary. Receptaculum seminis absent. Uterus extends upto postovarian region. Eggs oval to boat shaped and nonoperculate. Parasites of fresh water fishes.

***Pseudoauricularia baruanalensis* n.g., n.sp.**

Medium sized, unsegmented cestodes measure 12.0-14.0 (13.0) in length and 1.365-1.653 (1.509) in width. Scolex slightly pointed without any groove, cushion or spines and measures 1.141-1.334x0.656-0.705 (1.237x0.680). Neck absent.

Testes numerous, medullary, oval to round and measure 0.058-0.065 X 0.079-0.099 (0.061 X 0.089), situated above the level of cirrus pouch. Cirrus pouch oval to round measures 0.328-0.403 X 0.364-0.415 (0.365 X 0.389). External and internal seminal vesicles absent.

Female genitalia posteriorly situated. Ovary ear-shaped measures 0.734-0.778 X 0.821-0.915 (0.756 X 0.868), ovarian lobes partly cortical and partly medullary while ovarian isthmus entirely medullary.

Vitelline follicles partly cortical and partly medullary measure 0.030-0.051 X 0.055-0.076 (0.040 X 0.065), reaches below the level of cirrus pouch. Postovarian vitellaria and receptaculum seminis absent.

Uterus long, coiled, nonglandular, measures 1.940-2.315 X 0.653 - 1.177 (2.127 X 0.915), extends upto postovarian region. Male and female gonopores separately situated near the base of cirrus pouch.

Eggs oval to boat shaped and nonoperculate measure 0.026-0.036 X 0.058-0.070 (0.031 X 0.064).

DISCUSSION

Presently sixteen genera have been included in the family Capingentidae Hunter, 1930; order Caryophyllidea Beneden in carus, 1863.

The present form comes closer to the genera *Pseudolytocestus* Hunter, 1929; *Pseudoadenoscolex* Mathur and Srivastav, 1994; *Pseudoclariasis* Pathak, 2002 and *Pseudoinverta* Pathak, 2002 (Table 03).

The present form differs from *Pseudolytocestus* Hunter, 1929 in having well defined scolex, absence of external seminal vesicle, presence of ear-shaped ovary and uterus extend upto postovarian region.

From *Pseudoadenoscolex* Mathur and Srivastav, 1994 it differs in having medium sized worm, distinct scolex from rest of the body, absence of internal seminal vesicle, presence of ear-shaped ovary and uterus extend upto postovarian region.

From *Pseudoclariasis* Pathak, 2002 it differs in having slightly pointed scolex, absence of internal seminal vesicle, presence of ear-shaped ovary and nonoperculate eggs.

From *Pseudoinverta* Pathak, 2002 it differs in having medium sized worms, slightly pointed scolex, absence of internal seminal vesicle, Presence of ear - shaped ovary and absence of mehlis gland.

Thus the proposed new genus *Pseudoauricularia* n.g. differs from all the known genera of the family Capingentidae Hunter, 1930.

In the light of above discussion the species *Pseudoauricularia baruanalensis* n.g., n.sp. may be provisionally accommodated in the proposed new genus.

The species is named after the place of host collection.

Host : *Clarias batrachus* (Linn.)

Habitat : Intestine

Locality : Baruasagar, district Jhansi (U.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

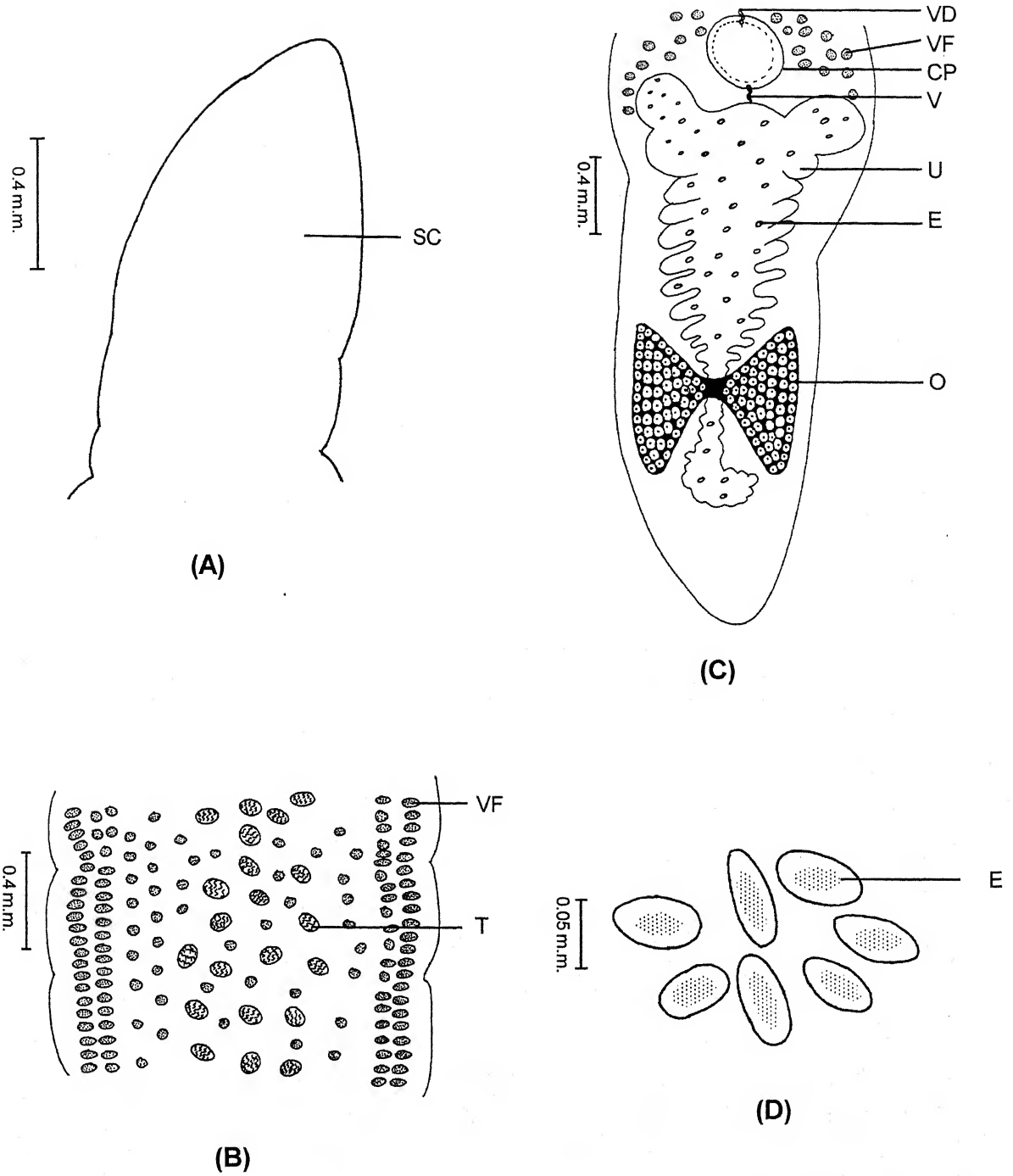


Fig. 03 : ***Pseudoauricularia baruanalensis*** n.g., n.sp., A - Scolex (50X), B - Middle region of the body (50X), C-Posterior region of the body (50X), D-Eggs (225X)

TABLE 03 : Comparison of the characters of the genera closer to *Pseudoauricularia* n.g.

S.No.	Characters	*Pseudolytocestus* Hunter, 1929	*Pseudoadenoscolex* Mathur and Srivastav 1994	*Pseudoclariasis* Pathak, 2002	*Pseudoinverta* Pathak, 2002	*Pseudoauricularia* n.g.
1	Size of worms	-	Large	Medium	Large	Medium
2	Scolex	Weakly defined	undifferentiate from rest of the body	Well defined and blunt	Well defined and blunt	Well defined and blunt
3	External seminal vesicle	Present	absent	absent	absent	absent
4	Internal seminal vesicle	Absent	Present	Present	Present	Absent
5	Ovary	H-Shaped	Inverted A- shaped	Fan- shaped	Inverted U-shaped	Ear-shaped
6	Uterus	Never extend upto postovarian region	Never extend upto postovarian region	Extended upto postovarian region	Extended upto postovarian region	Extended upto postovarian region
7	Mehlis gland	Absent	Absent	Absent	Present	Absent
8	Eggs.	-	Nonoperculate	Operculate	Nonoperculate	Nonoperculate

(2.3)
Pseudounevenata teharkaensis n.g., n.sp.

Order : Caryophyllidea Beneden in Carus, 1863

Family : Capingentidae Hunter, 1930

Genus : *Pseudounevenata* n.g.

Species : *Pseudounevenata teharkaensis* n.g., n. sp.

***Pseudounevenata teharkaensis* n.g., n.sp.** (Fig. 04)

Six fishes, *Clarias batrachus* (Linn.) caught from Teharka, district Tikamgarh (M.P.) India, two were found infected with three alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to a new genus *Pseudounevenata* n.g. of the family Capingentidae Hunter, 1930, order Caryophyllidea Beneden in Carus, 1863.

GENERIC DIAGNOSIS

Medium sized, unsegmented worms with flat, smooth, blunt scolex without any groove, cushion or spines. Neck absent. Well developed cirrus pouch with internal seminal vesicle. Uneven-bilobed ovary, posteriorly located, lateral lobes of ovary situated in cortex and medulla while isthmus situated in medulla. External seminal vesicle and receptaculum seminis absent. Vitellaria partly cortical and partly medullary, reaches below the level of cirrus pouch. Postovarian vitellaria absent. Testes medullary. Eggs oval and operculate. Parasites of fresh water fishes.

***Pseudounevenata teharkaensis* n.g., n.sp.**

Cestodes measure 10.0-16.0 (13.0) in length and 1.65-1.85 (1.75) in width. Scolex flat, smooth, blunt without any groove, cushion or spines. Scolex measures 1.158-1.364 X 0.678-0.853 (1.261 X 0.765). Neck absent.

Testes 40-80 in number, oval to round and medullary measure 0.068-0.101 X 0.119-0.145 (0.084 X 0.132), located anterior to cirrus pouch. Cirrus pouch oval, median and measures 0.234-0.264 X 0.414-0.459 (0.249

X 0.436). Internal seminal vesicle measures 0.164-0.193 X 0.047-0.063 (0.178 X 0.055). External seminal vesicle absent. Vas deferens measures 0.018-0.025 (0.021) in diameter.

Female genitalia posteriorly located. Ovary uneven - bilobed measures 0.389-0.514 X 1.153-1.314 (0.451 X 1.233), lateral lobes of ovary situated in cortex and medulla while isthmus situated in medulla.

Vitelline follicles partly cortical and partly medullary, measure 0.033-0.048 X 0.068-0.101 (0.040 X 0.084), reaches below the level of cirrus pouch. Postovarian vitellaria absent. Vagina measures 0.016-0.024 (0.020) in diameter. Receptaculum seminis absent.

Uterus long, coiled and nonglandular measures 1.226-1.388 X 0.853-1.030 (1.307 X 0.941). Uterus never reaches upto postovarian region. Male and female gonopores seperately opens into genital atrium.

Eggs oval and operculate measure 0.036 - 0.047 X 0.058-0.071 (0.041 X 0.064). Ventral longitudinal excretory canals measure 0.013-0.022 (0.017) in diameter while excretory pore measures 0.031-0.043 (0.037) in diameter.

DISCUSSION

Presently sixteen genera have been included in the family Capingentidae Hunter, 1930.

The present form comes closer to the genera *Pseudolytocestus* Hunter, 1929; *Pseudoadenoscolex* Mathur and Srivastav, 1994; *Pseudoclariasis* Pathak, 2002 and *Pseudoinverta* Pathak, 2002 (Table 04).

The present form differs from *Pseudolytocestus* Hunter, 1929 in having well defined scolex, absence of external seminal vesicle, presence of internal seminal vesicle and uneven-bilobed ovary.

From *Pseudoadenoscolex* Mathur and Srivastav, 1994 it differs in having medium sized worms, distinct scolex from rest of the body, uneven-bilobed ovary and operculate eggs.

From *Pseudoclariasis* Pathak, 2002 it differs in having uneven-bilobed ovary and absence of uterus upto postovarian region.

From *Pseudoinverta* Pathak, 2002 it differs in having medium sized worms, uneven-bilobed ovary, absence of mehils gland, absence of uterus upto postovarian region and presence of operculate eggs.

Thus the proposed new genus *Pseudounevenata* n.g. differs from all the known genera of the family Capingentidae Hunter, 1930.

In the light of above discussion the species *Pseudounevenata teharkaensis* n.g., n.sp. may be provisionally accommodated in the proposed new genus.

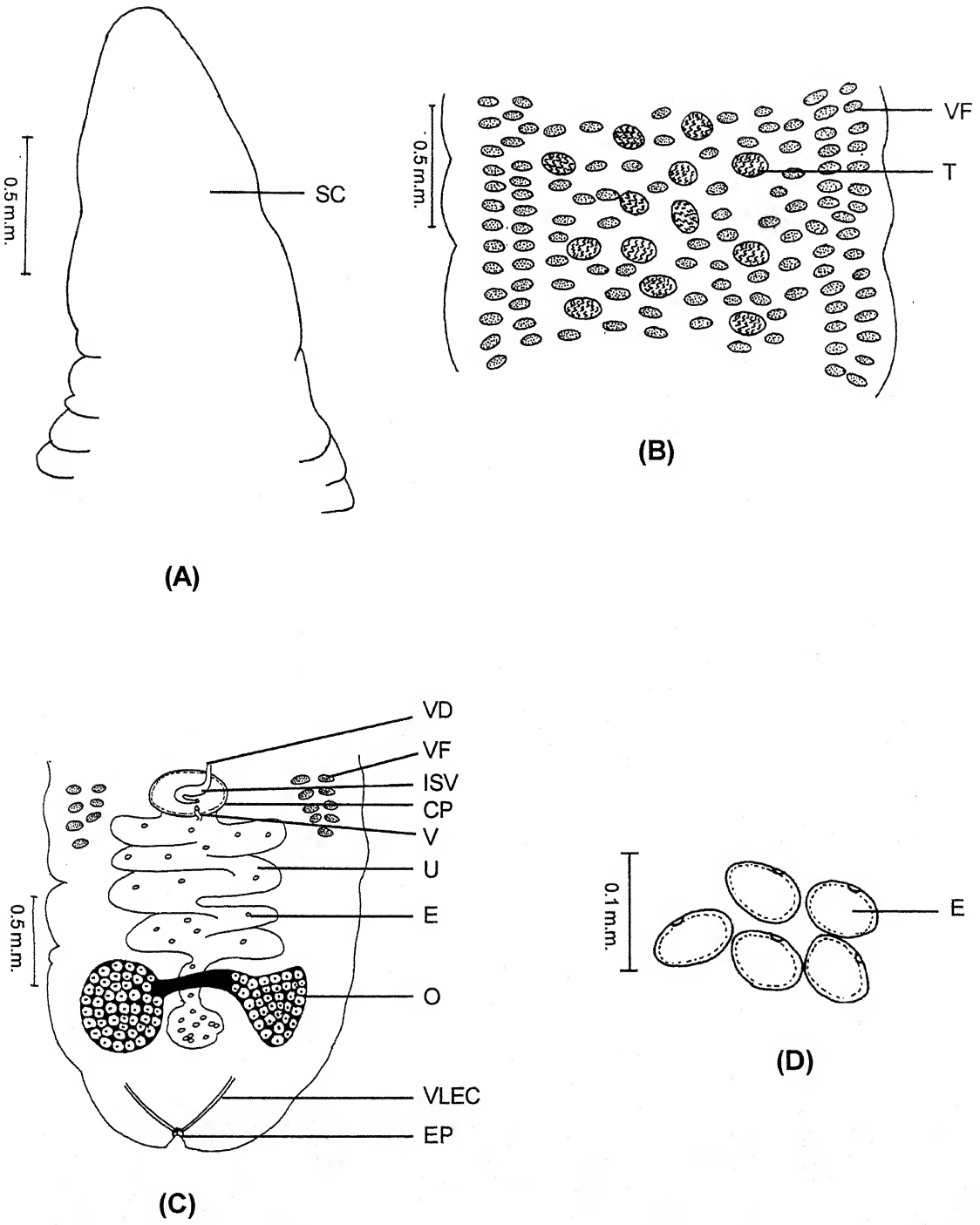
The species is named after the place of host collection.

Host : *Clarias batrachus* (Linn.)

Habitat : Intestine

Locality : Teharka, district Tikamgarh (M.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.



n. gen

Fig. 04 : ***Pseudounevenata teharkaensis*** *n.g.,* n.sp., A - Scolex (50X), B - Middle region of the body (50X), C-Posterior region of the body (50X), D-Eggs (225X)

TABLE 04 : Comparison of the characters of the genera closer to *Pseudounevenata* n.g.

S.No.	Characters	*Pseudolytocestus* Hunter, 1929	*Pseudoadenoscolex* Mathur and Srivastav, 1994	*Pseudoclariasis* Pathak, 2002	*Pseudoinverta* Pathak, 2002	*Pseudounevenata* n.g.
1	Size of worms	-	Large	Medium	Large	Medium
2	Scolex	Weakly defined	Undifferentiate from rest of the body	Well defined	Well defined	Well defined
3	External seminal vesicle	Present	Absent	Absent	Absent	Absent
4	Internal seminal vesicle	Absent	Present	Present	Present	Present
5	Ovary	H-shaped	Inverted A-shaped	Fan-shaped	Inverted U-shaped	Uneven-biolobed
6	Mehlis gland	Absent	Absent	Absent	Present	Absent
7	Uterus	Never extend upto postovarian region	Never extend upto postovarian region	Extended upto postovarian region	Extended upto postovarian region	Never extend upto postovarian region
8	Eggs	-	Nonoperculate	Operculate	Nonoperculate	Operculate

(2.4)
Pseudobilobulata malhotrai
n.sp.

Order : Caryophyllidea Beneden in Carus, 1863

Family : Capingentidae Hunter, 1930

Genus : *Pseudobilobulata* Srivastav and Lohia, 2002

Species : *Pseudobilobulata malhotrai* n. sp.

***Pseudobilobulata malhotrai* n. sp.** (Fig. 05)

Ten fishes, *Clarias batrachus* (Linn.) caught from Baruasagar, district Jhansi (U.P.) India, five were found infected with eight alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to the genus *Pseudobilobulata* Srivastav and Lohia, 2002 of the family Capingentidae Hunter, 1930, order Caryophyllidea Beneden in Carus, 1863.

Cestodes medium sized and unsegmented measure 10.5-13.5 X 1.014 - 1.103 (12.0 X 1.058). Scolex pointed and smooth measures 1.028-1.262 X 0.491-0.651 (1.145 X 0.571), without any additional structure like groove, cushion or sucker. Neck small measures 1.032-1.165 X 0.568 - 0.694 (1.098 X 0.631).

Testes numerous, medullary and oval to round measure 0.068-0.084 X 0.072 - 0.091 (0.076 X 0.081), scattered anterior to cirrus pouch. Cirrus pouch oval to round and median measures 0.303-0.416 X 0.307 - 0.388 (0.359 X 0.347). Internal and external seminal vesicles absent. Vas deferens measures 0.019-0.026 (0.022) in diameter.

Female genitalia posteriorly located. Ovary bilobed measures 0.303-0.403 X 0.706-0.803 (0.353 X 0.754), lobes of ovary situated in cortex and medulla region while ovarian isthmus in medulla only.

Vitelline follicles partly cortical and partly medullary measure 0.036-0.043 X 0.037 - 0.049 (0.039 X 0.043), reaches below the level of cirrus pouch. Receptaculum seminins measures 0.062 - 0.075 X 0.125 - 0.138 (0.068 X 0.131).

Uterus long, coiled and nonglandular measures 0.934-1.521 X 0.528 - 0.728 (1.227 X 0.628). Vagina measures 0.014-0.020 (0.017) in diameter. Male and female gonopores separately situated at the base of cirrus pouch.

Eggs oval and nonoperculate measure 0.027-0.033 X 0.039 - 0.048 (0.030 X 0.043). Excretory pore measures 0.024-0.037 (0.030) in diameter.

DISCUSSION

The present form comes closer to *Pseudobilobulata batrachus* Srivastav and Lohia, 2002.

From *Pseudobilobulata batrachus* Srivastav and Lohia, 2002 it differs in having larger and broader worms, larger and pointed scolex, larges testes, larger cirrus pouch, larger ovary, larger vitellaria, presence of receptaculaum seminis and larger eggs (Table 05)

In the light of above discussion the present form may be provisionally accommodated in the proposed new species *Pseudobilobulata malhotrai* n.sp.

The name of the species is after Prof. S.K.Malhotra, Cestodologist, University of Allahabad, Allahabad, (U.P.) India.

Host : *Clarias batrachus* (Linn.)

Habitat : Intestine

Locality : Baruasagar, district, Jhansi (U.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

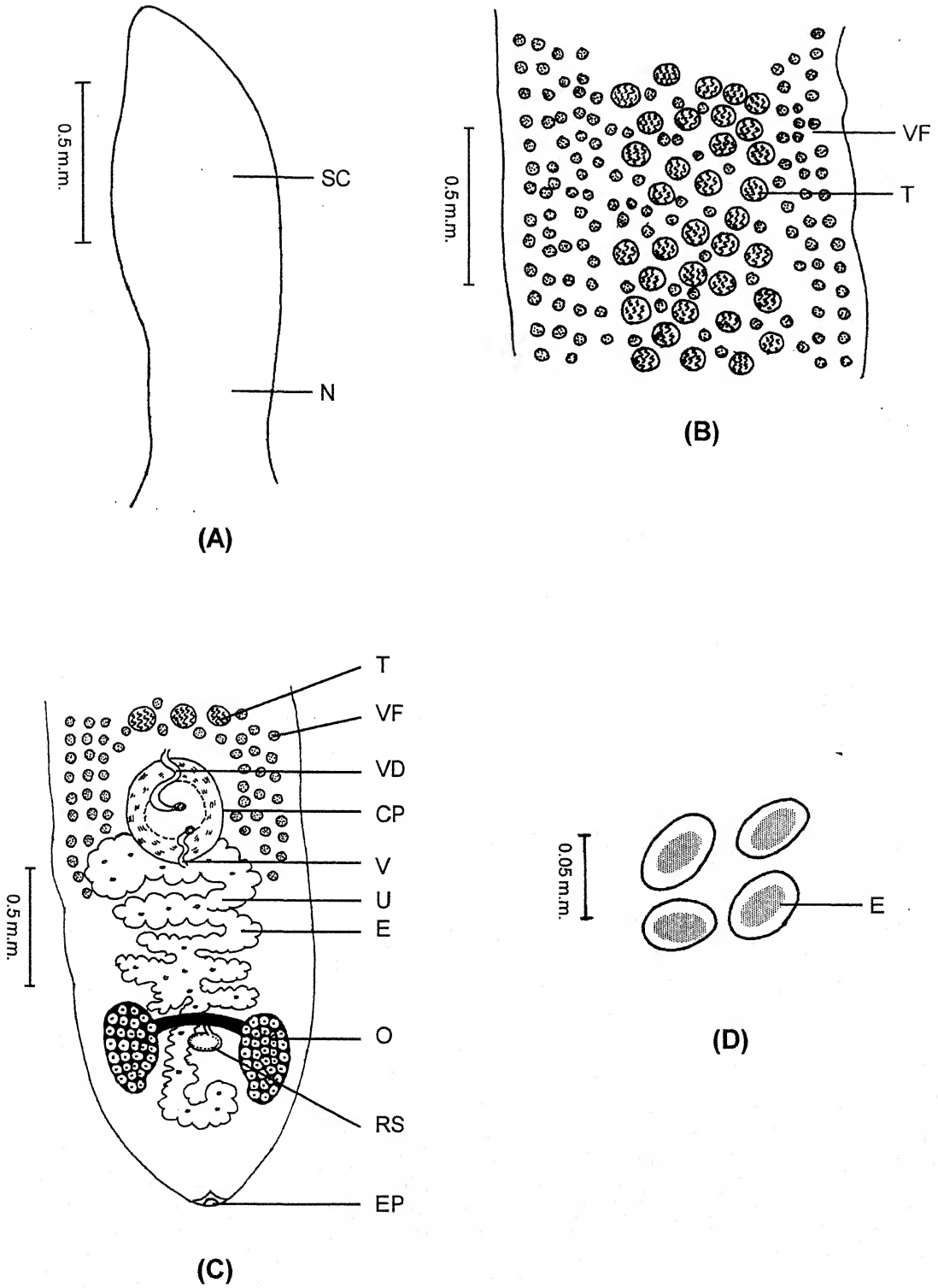


Fig. 05 : ***Pseudobilobulata malhotrai*** n.sp., A - Scolex with neck (50X), B - Middle region of the body (50X), C-Posterior region of the body (50X), D-Eggs (225X)

TABLE 05 : Comparison of the characters of the species closer to P*seudobilobulata malhotrai* n.sp.

S. No.	Characters	*Pseudobilobulata batrachus* Srivastav and Lohia, 2002	*Pseudobilobulata malhotrai* n.sp.
1	Size of worms	1.32-1.62 X 0.390-0.48	10.5-13.5 X 1.014-1.103
2	Scolex	Blunt (0.29-0.48 X 0.09-0.15)	Pointed (1.028-1.262 X0.491-0.651)
3	Neck	-	1.098 X 0.631
4	Testes	0.006-0.018 X 0.012-0.018	0.068-0.084 X 0.072-0.091
5	Cirrus Pouch	0.048-0.072 X 0.050-0.056	0.303-0.416 X 0.307 - 0.388
6	Internal seminal vesicle	Absent	Absent
7	External seminal veside	Absent	Absent
8	Ovary Shape Size	 Bilobed 0.20-0.36 X 0.058-0.105	 Bilobed 0.303-0.403 X 0.706-0.803
9	Vitellaria	0.001-0.012 X 0.001-0.012	0.036-0.043 X 0.037-0.049
10	Receptaculum seminis	Absent	Present
11	Uterus	0.333 X 0.05	0.934-1.521 X 0.528-0.728
12	Eggs Type Size	 Nonoperculate 0.012-0.018 X 0.014 - 0.022	 Nonoperculate 0.027-0.033 X 0.039-0.048
13	Host	Clarias *batrachus*	*Clarias batrachus*

(2.5)
Pseudoheteroinverta tikamgarhensis
Srivastav and Khare, 2005

Order	:	Caryophyllidea Beneden in Carus, 1863
Family	:	Capingentidae Hunter, 1930
Genus	:	*Pseudoheteroinverta* Srivastav and Khare, 2005
Species	:	*Pseudoheteroinverta tikamgarhensis* Srivastav and Khare, 2005

* ***Pseudoheteroinverta tikamgarhensis* Srivastav and Khare, 2005** (Fig. 06)

Eight fishes, *Heteropneustes fossilis* (Bloch) caught from Prithvipur, district Tikamgarh (M.P.) India, one was found infected with single unique cestode in its intestine. Morphological studies of the cestode revealed it to belong to the genus *Pseudoheteroinverta* Srivastav and Khare, 2005 of the family Capingentidae Hunter, 1930; order Caryophyllidea Beneden in Carus, 1863.

GENERIC DIAGNOSIS

Medium sized, unsegmented worm with flat, smooth and blunt scolex without any groove, cushion or spines. Neck medium sized. Testes numerous medullary and anterior to cirrus pouch. Cirrus pouch small, oval and median. External and internal seminal vesicles absent. Ovary inverted A-shaped. Vitellaria partly cortical and partly medullary, reaches below the level of cirrus pouch near the ovarian arms, but never touches it. Postovarian vitellaria absent. Receptaculum seminis absent. Uterus long, coiled and nonglandular. Eggs oval to round and nonoperculate. Parasites of fresh water fishes.

***Pseudoheteroinverta tikamgarhensis* Srivastav and Khare, 2005**

Medium sized, unsegmented worm measures 13.0 in length and 0.40 - 0.90 (0.65) in width. Scolex flat, smooth and blunt measures 0.55 X 0.18-0.24 (0.55 X 0.21), without any groove, cushion or spines. Neck medium measures 1.2 X 0.2 - 0.3 (1.2 X 0.25).

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* Published in *Flora and Fauna*, 2005 Vol. **11** No. **2** pp. 151-154.

Testes numerous, medullary and oval to round measure 0.04-0.08 X 0.03 - 0.05 (0.06 X 0.04), scattered anterior to cirrus pouch. Cirrus pouch small, oval and median measures 0.12 X 0.22. External and internal seminal vesicles absent.

Female genitalia posteriorly situated. Ovary inverted A-shaped measures 1.0-1.05 X 0.55-0.68 (1.025 X 0.615), lateral lobes of ovary situated in cortex and medulla while isthmus and posterior end of ovary situated in medulla.

Vitelline follicles partly cortical and partly medullary measure 0.015-0.02 X 0.03 - 0.05 (0.017 X 0.04), reaches below the level of cirrus pouch near the ovarian arms but never touches it. Postovarian vitellaria and receptaculum seminis absent.

Uterus long, coiled and nonglandular measures 1.7 X 0.2 - 0.4 (1.7 X 0.3), uterine coils not extending anterior to cirrus pouch.

Eggs oval to round and nonoperculate measure 0.012 - 0.015 X 0.016 - 0.020 (0.013 X 0.018). Excretory pore measures 0.02 - 0.03 (0.025) in diameter.

DISCUSSION

The present form comes closer to the genera *Pseudocaryophyllaeus* Gupta, 1961; *Pseudobilobulata* Srivastav and Lohia, 2002; *Pseudobatrachus* Pathak and Srivastav, 2005 and *Heeradevina* Srivastav and Khare, 2005 of the family Capingentidae Hunter, 1930; order Caryophyllidea Beneden in Carus, 1863 (Table 06).

The present form differs from *Pseudocaryophyllaeus* Gupta, 1961 in having smaller neck, absence of internal seminal vesicle and presence of inverted A-shaped ovary.

From *Pseudobilobulata* Srivastav and Lohia, 2002 it differs in having larger neck and inverted A-shaped ovary.

From *Pseudobatrachus* Pathak and Srivastav 2005 it differs in having absence of groove on scolex, Presence of smaller neck, numerous testes, absence of ejaculatary duct, presence of inverted A-shaped ovary and nonoperculate eggs.

From *Heeradevina* Srivastav and Khare, 2005 it differs in having smaller neck and absence of receptaculum seminis.

Thus the proposed genus *Pseudoheteroinverta* Srivastav and Khare, 2005 differs from all the known genera of the family Capingentidae Hunter, 1930.

In the light of above discussion the species, *Pseudoheteroinverta tikamgarhensis* Srivastav and Khare, 2005 has been erected.

The species is named after the district from where it was collected.

Host : *Heteropneustes fossilis* (Bloch)

Habitat : Intestine

Locality : Prithvipur, district Tikamgarh (M.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

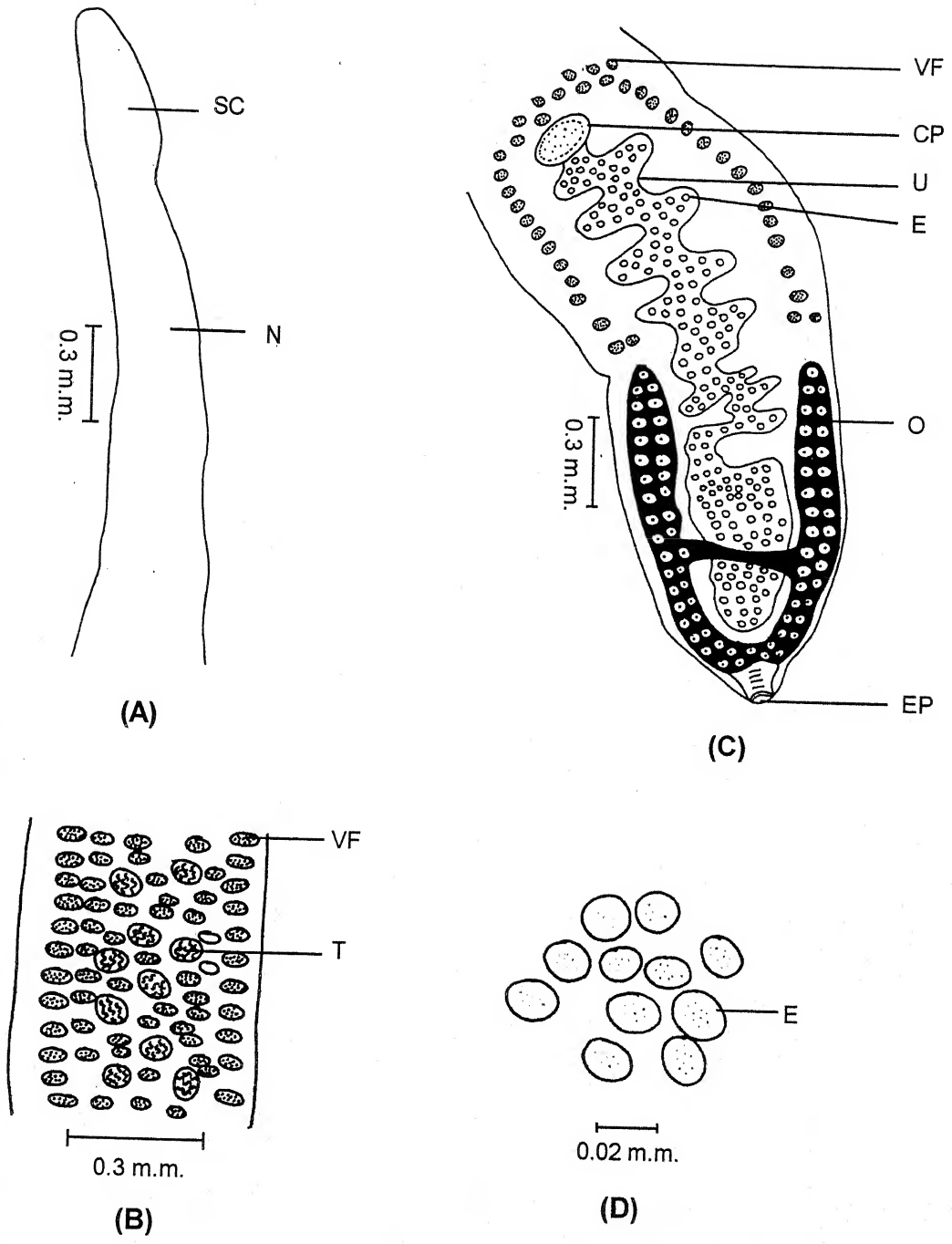

Fig. 06 : ***Pseudoheteroinverta tikamgarhensis*** Srivastav and Khare; 2005, A - Scolex with neck (50X), B - Middle region of the body (50X), C-Posterior region of the body (50X), D-Eggs (225X)

TABLE 06 : Comparison of the characters of the genera closer to *Pseudoheteroinverta* Srivastav and Khare, 2005

S.No.	Characters	*Pseudocaryophyllaeus* Gupta, 1961	Pseudobiolobulata Srivastav and Lohia 2002	Pseudobatrachus Pathak and Srivastava 2005	*Heeradevina* Srivastaa and Khare, 2005	*Pseudoheteroinverta* n.g.
1	Groove on scolex	Absent	Absent	Present	Absent	Absent
2	Neck	Very long	Small	Very long	Very long	Medium
3	Number of testes	Numerous	Numerous	5-10	Numerous	Numerous
4	Internal seminal vesicle	Present	Absent	Absent	Absent	Absent
5	Ejaculatory duct	Absent	Absent	Present	Absent	Absent
6	Ovary	Band-shaped	Bilobed	H-shaped	Inverted A-shaped	Inverted A-Shaped
7	Receptaculum seminis	Absent	Absent	Absent	Present	Absent
8	Eggs	Nonoperculate	Nonoperculate	Operculate	Nonoperculate	Nonoperculate

(2.6)
Sukhpatae prathvipurensis
n.g., n.sp.

Order : Caryophyllidea Beneden in Carus, 1863

Family : Capingentidae Hunter, 1930

Genus : *Sukhpatae* n.g.

Species : *Sukhpatae prathvipurensis* n.g., n.sp.

*** *Sukhpatae prathvipurensis* n.g., n.sp.** (Fig. 07)

Eight fishes, *Heteropneustes fossilis* (Bloch) caught from Prithvipur, district Tikamgarh (M.P.) India, two were found infected with two alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to a new genus *Sukhpatae* n.g. of the family Capingentidae Hunter, 1930; order Caryophyllidea Beneden in Carus, 1863.

GENERIC DIAGNOSIS

Medium sized, unsegmented worms with simple and blunt scolex without any additional structure like groove, cushion or hooks. Neck medium sized, testes numerous, medullary and situated anterior to cirrus pouch. Cirrus pouch oval to round and median. External and internal seminal vesicles absent. Ovary omega-shaped. Vitellaria partly cortical and partly medullary, reaches upto the level of ovary but never touches the ovarian arms. Postovarian vitellaria and receptaculum seminis absent. Uterus long, coiled and non glandular, uterine coils not extending anterior to cirrus pouch. Eggs oval to round and nonoperculate.

***Sukhpatae prathvipurensis* n.g., n.sp.**

Medium sized, unsegmented worms measure 13.0-15.0 (14.0) in length and 0.2-0.5 (0.35) in width. Scolex simple and blunt measures 0.26-0.40 X 0.17-

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* Published in 16th All India Congress of Zoology and National Symposium on Recent Advances in Animal Research with special emphasis on invertebrates, 21-23 Oct, 2005 at Aurangabad. Abs. No. 50 p. 49.

0.20 (0.33 X 0.185), without any additional structure like groove, cushion or hooks. Medium sized neck measures 2.20-3.0 X 0.20 - 0.22 (2.6 X 0.21).

Testes numerous, medullary and oval to round measure 0.028-0.035 X 0.030-0.050 (0.031 X 0.04), situated anterior to cirrus pouch. Cirrus pouch oval to round and median measures 0.10-0.14 X 0.12-0.16 (0.12 X 0.14). External and internal seminal vesicles absent.

Female genitalia posteriorly situated. Ovary omega-shaped measures 0.35-0.50 X 0.25 - 0.36 (0.425 X 0.305), lateral lobes of ovary situated in cortex and medulla while lower middle part of ovary situated in medulla.

Vitelline follicles partly cortical and partly medullary measure 0.12 - 0.20 X 0.18-0.30 (0.16 X 0.24), reaches upto the level of ovary but never touches the ovarian arms. Postovarian vitellaria and receptaculum seminis absent.

Uterus long, coiled and nonglandular measures 0.45-0.94 (0.65) in length and 0.20-0.28 (0.24) in width, uterine coils not extending anterior to cirrus pouch. Male and female gonopores separately situated at the base of cirrus pouch.

Eggs oval to round and nonoperculate measure 0.015-0.018 X 0.020-0.025 (0.016 X 0.022).

DISCUSSION

Presently sixteen genera have been included in the family Capingentidae Hunter, 1930; order Caryophyllidea Beneden in Carus, 1863.

The present form comes closer to *Pseudocaryophyllaeus* Gupta, 1961; *Pseudobilobulata* Srivastav and Lohia, 2002; *Pseudobatrachus* Pathak and Srivastav, 2005; *Heeradevina* Srivastav and Khare, 2005 and *Pseudoheteroinverta* Srivastav and Khare 2005 (Table 07).

The present form differs from *Pseudocaryophyllaeus* Gupta, 1961 in having medium sized neck, absence of internal seminal vesicle and presence of omega-shaped ovary.

From *Pseudobilobulata* Srivastav and Lohia, 2002 it differs in having medium sized neck and omega-shaped ovary.

From *Pseudobatrachus* Pathak and Srivastav, 2005 it differs in having absence of groove on scolex, presence of medium sized neck, numerous testes, absence of ejaculatory duct, presence of omega-shaped ovary and nonoperculate eggs.

From *Heeradevina* Srivastav and Khare, 2005 it differs in having medium sized neck, omega-shaped ovary and absence of receptaculum seminis.

From *Pseudoheteroinverta* Srivastav and Khare, 2005 it differs in having Omega - shaped ovary.

Thus the proposed new genus *Sukhpatae* n.g. difers from all the known genera of the family Capingentidae Hunter, 1930.

Inthe light of above discussion the species *Sukhpatae prathvipurensis* n.g., n.sp. may be provisionally accommodated in the proposed new genus.

The genus is named after eminent social worker Sukhpati Devi while species is named after the place from where it was collected.

Host : *Heteropneustes fossilis*

Habitat : Intestine

Locality : Prithvipur, district Tikamgarh (M.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College Jhansi, (U.P.) India.

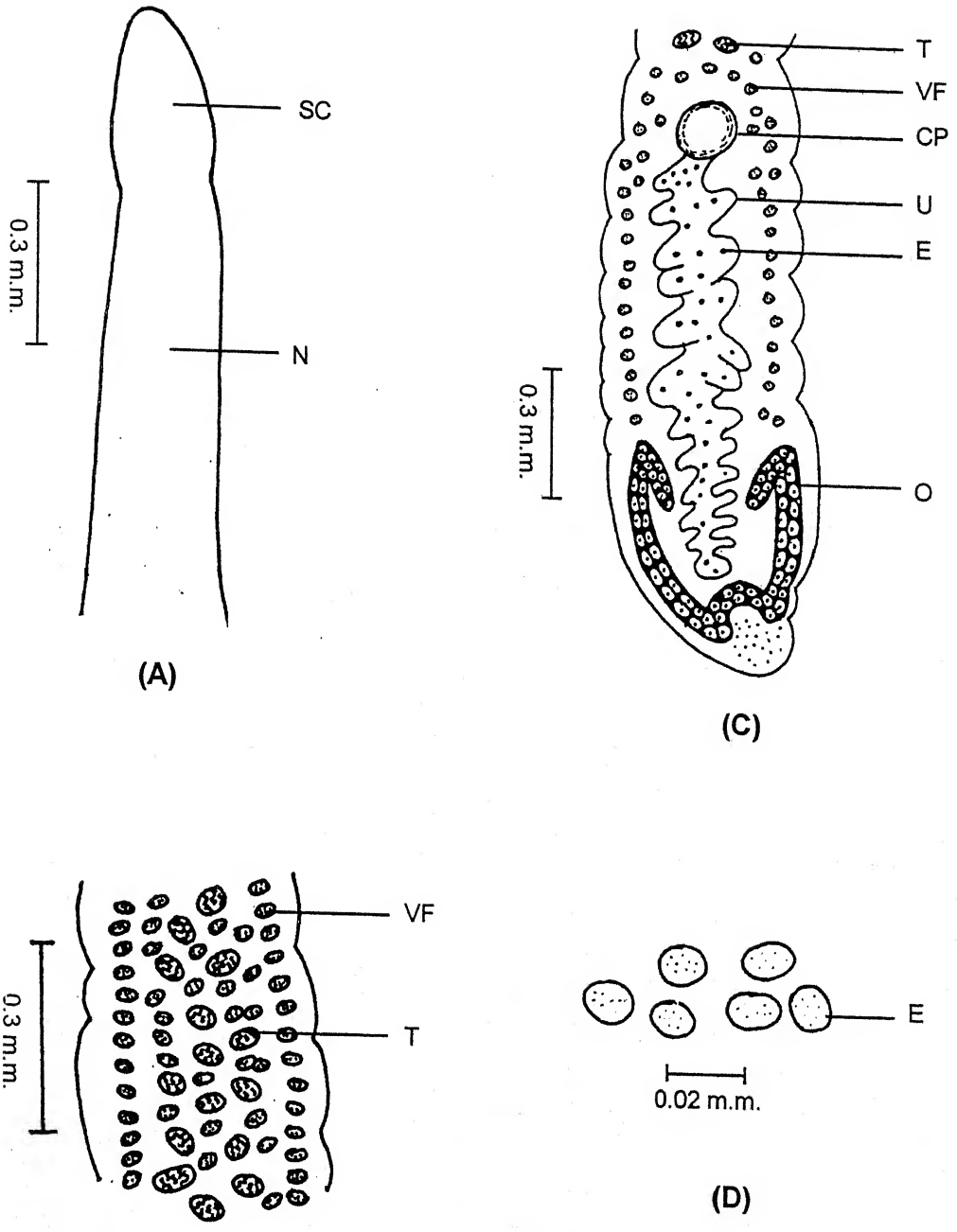

Fig. 07 : ***Sukhpatae prathvipurensis*** n.g., n.sp., A - Scolex with neck (50X), B - Middle region of the body (50X), C-Posterior region of the body (50X), D-Eggs (225X)

TABLE 07 : Comparison of the characters of the genera closer to *Sukhpatae* n.g.

S.No.	Characters	*Pseudocaryophyllaeus* Gupta, 1961	*Pseudobilobulata* Srivastav and Lohia, 2002	*Pseudobatrachus* Pathak and Srivastav,2005	*Heeradevina* Srivastav and Khare, 2005	*Pseudoheteroinverta* Srivastav and Khare, 2005	*Sukhpatae* n.g.
1	Groove on scolex	Absent	Absent	Present	Absent	Absent	Absent
2	Neck	Very long	Small	Very long	Very long	Medium	Medium
3	Number of testes	Numerous	Numerous	5-10	Numerous	Numerous	Numerous
4	Internal seminal vesicle	Present	Absent	Absent	Absent	Absent	Absent
5	Ejaculatory duct	Absent	Absent	Present	Absent	Absent	Absent
6	Ovary	Band-shaped	Bilobed	H-shaped	Inverted A-shaped	Inverted A-shaped	Omega-shaped
7	Receptaculum seminis	Absent	Absent	Absent	Present	Absent	Absent
8	Eggs	Nonoperculate	Nonoperculate	Operculate	Nonoperculate	Nonoperculate	Nonoperculate

(2.7)
Sudhaena khurdensis
n.g., n.sp.

Order : Caryophyllidea Beneden in Carus, 1863

Family : Capingentidae Hunter, 1930

Genus : *Sudhaena* n.g.

Species : *Sudhaena khurdensis* n.g., n.sp.

***Sudhaena khurdensis* n.g. n. sp.** (Fig. 08)

Seven fishes, *Heteropneustes fossilis* (Bloch) caught from Khurd, district Jhansi (U.P.) India, two were found infected with three alike cestodes in their intestines.Morphological studies of the cestodes revealed them to belong to a new genus *Sudhaena* n.g. of the family Capingentidae Hunter, 1930; Order Caryophyllidea Beneden in Carus, 1863.

GENERIC DIAGNOSIS

Medium sized and unsegmented worms with simple blunt scolex without any groove, cushion or spines. Neck medium sized. Testes numerous, oval to round and medullary. Cirrus pouch well developed with or without internal seminal vesicle. External seminal vesicle absent. Ovary M-shaped with long arms, Partly cortical and partly medullary. Vitellaria oval to round, partly cortical and partly medullary, reaches below the level of cirrus pouch. Postovarian vitellaria absent. Uterus long, coiled and nonglandular, uterine coils not extending anterior to cirrus pouch. Eggs oval to round and operculate. Parasites of fresh water fishes.

***Sudhaena khurdensis* n.g. n. sp.**

Medium sized, unsegmented cestodes measure 14.0-18.0 (16.0) in length and 0.778-1.215 (0.996) in width. Scolex simple and blunt measures 0.541-0.597 X 0.265-0.299 (0.569 X 0.282), without any groove, cushion or spines. Neck medium sized measures 2.015 - 2.164 X 0.234 - 0.262 (2.089 X 0.248).

Testes numerous, oval to round and medullary measure 0.051-0.065 X 0.074 - 0.099 (0.058 X 0.086), reaches upto the level of cirrus pouch. Cirrus pouch cap shaped and median measures 0.103 - 0.130 X 0.440 - 0.501 (0.116 X 0.470). Internal seminal vesicle measures 0.043 - 0.055 X 0.068-0.089 (0.049 X 0.078). External seminal vesicle absent. Vas deferens measures 0.013-0.023 (0.018) in diameter.

Female genitalia posteriorly situated. Ovary M-shaped with equal long arms measures 1.476-1.565 X0.694-1.076 (1.520 X 0.885), partly cortical and partly medullary.

Vitelline follicles oval to round, partly cortical and partly medullary measure 0.037-0.056 X 0.052 - 0.072 (0.046 X 0.062), reaches below the level of cirrus pouch. Postovarian vitellaria absent. Vagina measure 0.008-0.012 (0.010) in diameter. Receptaculum seminis absent.

Uterus long, coiled and nonglandular measures 2.54-2.87 X 0.555-0.833 (2.70 X 0.694), uterine coils not extending anterior to cirrus pouch. Male and female gonopores separately situated at the base of cirrus pouch.

Eggs oval to round and operculate measure 0.018 - 0.022 X 0.021 - 0.039 (0.020 X 0.030). Ventral longitudinal excretory canals measure 0.011 - 0.013 (0.012) in diameter while excretory pore measure 0.012 - 0.015 (0.013) in diameter.

DISCUSSION

Presently sixteen genera have been included in the family Capingentidae Hunter, 1930; Order Caryophyllidea Beneden in Carus, 1863.

The present form comes closer to the genera *Pseudocaryophyllaeus* Gupta, 1961; *Pseudobilobulata* Srivastav and Lohia, 2002; *Pseudobatrachus*

Pathak and Srivastav, 2005; *Heeradevina* Srivastav and Khare, 2005 and *Pseudoheteroinverta* Srivastav and Khare, 2005 (Table 08).

The present form differs from *Pseudocaryophyllaeus* Gupta, 1961 in having medium sized neck, M-Shaped ovary with long arms and operculate eggs.

From *Pseudobilobulata* Srivastav and Lohia, 2002 it differs in having medium sized neck, M-shaped ovary with long arms and operculate eggs.

From *Pseudobatrachus* Pathak and Srivastav, 2005 it differs in having absence of grove on scolex, presence of medium sized neck, numerous testes, absence of ejaculatory duct and presence of M-shaped ovary with long arms.

From *Heeradevina* Srivastav and Khare, 2005 it differs in having medium sized neck, M-shaped ovary with long arms and operculate eggs.

From *Pseudoheteroinverta* Srivastav and Khare, 2005 it differs in having M-shaped ovary with long arms and operculate eggs.

Thus the proposed new genus *Sudhaena* n.g. differs from all the known genera of the family Capingentidae Hunter, 1930.

In the light of above discussion the species *Sudhaena khurdensis* n.g., n.sp. may be provisionally accommodated in the proposed new genus

The name of the genus is after an eminent social worker Smt. Sudha Khare and species is named after the place of host collection.

Host : *Heteropneustes* fossilis (Bloch)

Habitat : Intestine

Locality : Khurd, district Jhansi (U.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

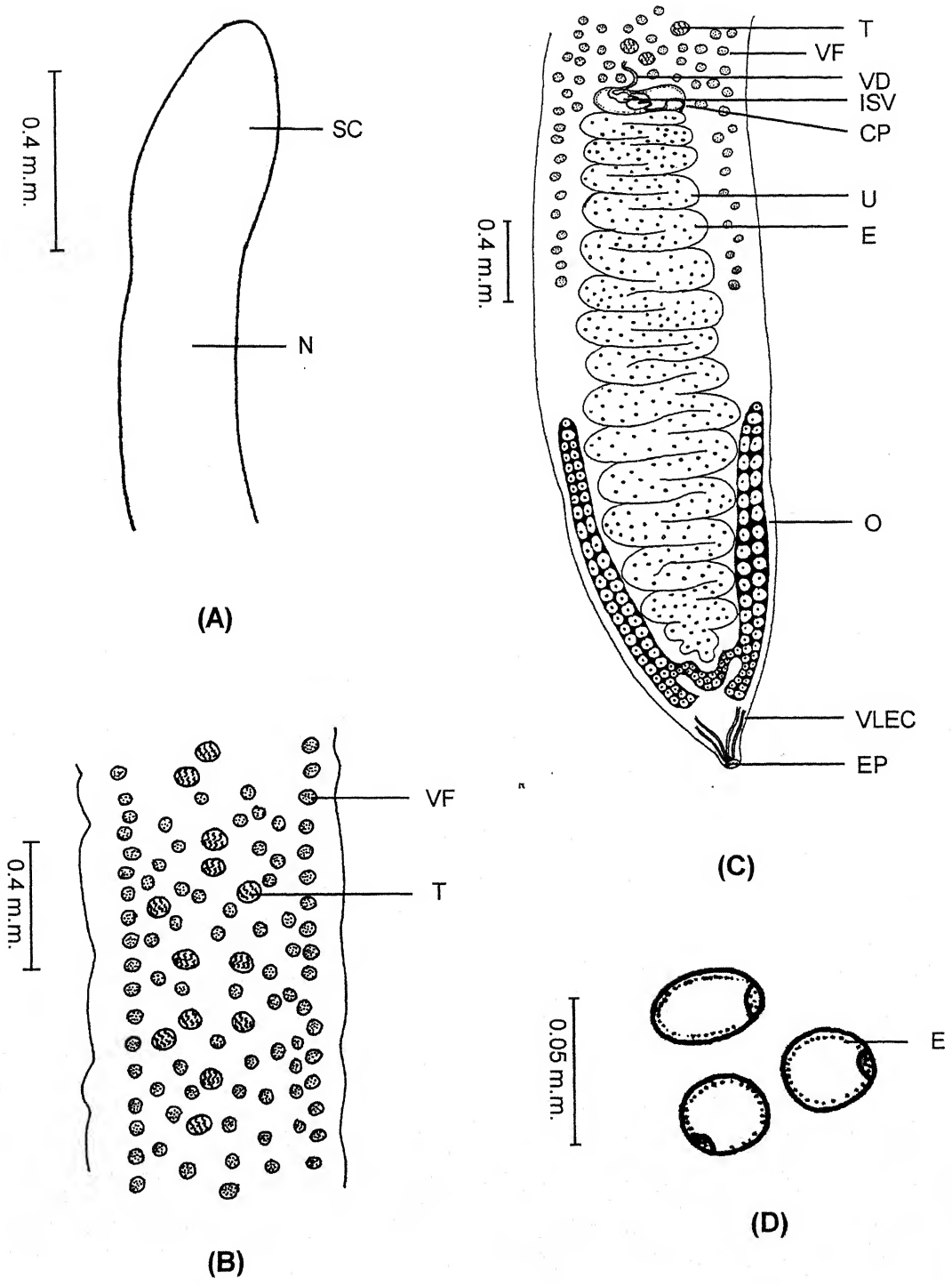

Fig. 08 : ***Sudhaena khurdensis*** n.g., n.sp., A - Scolex with neck (50X), B - Middle region of the body (50X), C-Posterior region of the body (50X), D-Eggs (225X)

TABLE 8 : Comparison of the characters of the genera closer to *Sudhaena* n.g.

S. No.	Characters	*Pseudocaryophyllaeus* Gupta, 1961	*Pseudobilobulata* Srivastav and Lohia, 2002	*Pseudobatrachus* Pathak and Srivastav,2005	*Heeradevina* Srivastav and Khare, 2005	Pseudoheteroinverta Srivastav and Khare, 2005	*Sudhaena* n.g.
1	Groove on scolex	Absent	Absent	Present	Absent	Absent	Absent
2	Neck	Very long	Small	Very long	Very long	Medium	Medium
3	Number of testes	Numerous	Numerous	5-10	Numerous	Numerous	Numerous
4	Ejaculatory duct	Absent	Absent	Present	Absent	Absent	Absent
5	Ovary	Band-shaped	Bilobed	H-shaped	Inverted A-shaped	Inverted A-shaped	M-shaped with long arms
6	Eggs	Nonoperculate	Nonoperculate	Operculate	Nonoperculate	Nonoperculate	Operculate

(2.8)
Sudhaena udaypali
n.g., n.sp.

Order : Caryophyllidea Beneden in Carus, 1863

Family : Capingentidae Hunter, 1930

Genus : *Sudhaena* n.g.

Species : *Sudhaena udaypali* n.g., n.sp.

***Sudhaena udaypali* n.g., n.sp.** (Fig. 09)

Twelve fishes, *Heteropneustes fossilis* (Bloch) caught from Teharka, district Tikamgarh (M.P.) India, two were found infected with three alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to a new genus *Sudhaena* n.g. of the family Capingentidae Hunter, 1930; Order Caryophyllidea Beneden in Carus, 1863.

Medium sized, unsegmented cestodes measure 16.0 - 20.0 (18.0) in length and 0.751-1.274 (1.012) in width. Scolex simple and blunt measures 0.501-0.591 X 0.230-0.277 (0.546 X 0.253), without any groove, cushion or spines. Neck medium sized measures 2.261-2.792 X 0.315-0.401 (2.526 X 0.358).

Testes numerous, oval to round and medullary measure 0.050 - 0.073 X 0.074-0.099 (0.061 X 0.086), reaches upto the level of cirrus pouch. Cirrus pouch oval to round and median measures 0.127-0.151 X 0.230-0.265 (0.139 X 0.247). Internal and external seminal vesicles absent. Vas deferens measures 0.006-0.012 (0.009) in diameter.

Female genitalia posteriorly situated. Ovary M-shaped with unequal long arms measures 1.251-1.662 X 0.909-1.047 (1.456 X 0.978), partly cortical and partly medullary.

Vitelline follicles oval to round, partly cortical and partly medullary measure 0.040-0.051 X 0.042-0.061 (0.045 X 0.051), reaches near the level

of ovary. Postovarian vitellaria absent. Vagina measures 0.005-0.008 (0.006) in diameter. Receptaculum seminis absent.

Uterus long, coiled and non glandular mesures 2.389-2.765 X 0.505-0.765 (2.577 X 0.635), uterine coils not extending anterior to cirrus pouch. Male and female gonopores located separately at the base of cirrus pouch.

Eggs rounded and operculate measure 0.025-0.027 X 0.025-0.027 (0026x0.026). Ventral longitudinal excretory canals measure 0.011-0.013 (0.012) in diameter while excretory pore measures 0.031-0.049 (0.040) in diameter.

DISCUSSION

The present form comes closer to *Sudhaena khurdensis* n.g., n.sp.

The present form differs from *Sudhaena khurdensis* n.g., n.sp. in having larger worms, smaller scolex, larger neck, oval to round cirrus pouch, absence of internal seminal vesicle, presence of smaller and unequally armed ovary, presence of few vitellaria near the level of ovary, smaller uterus and presence of rounded and larger eggs (Table 09).

In the light of above discussion the present form may be provisionally accommodated in the proposed new species, *Sudhaena udaypali* n.g., n.sp.

The name of the species is after an eminent person Dr. U.P. Singh, Principal, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

Host : *Heteropneustes* fossilis (Bloch)

Habitat : Intestine

Locality : Teharka, district Tikamgarh (M.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

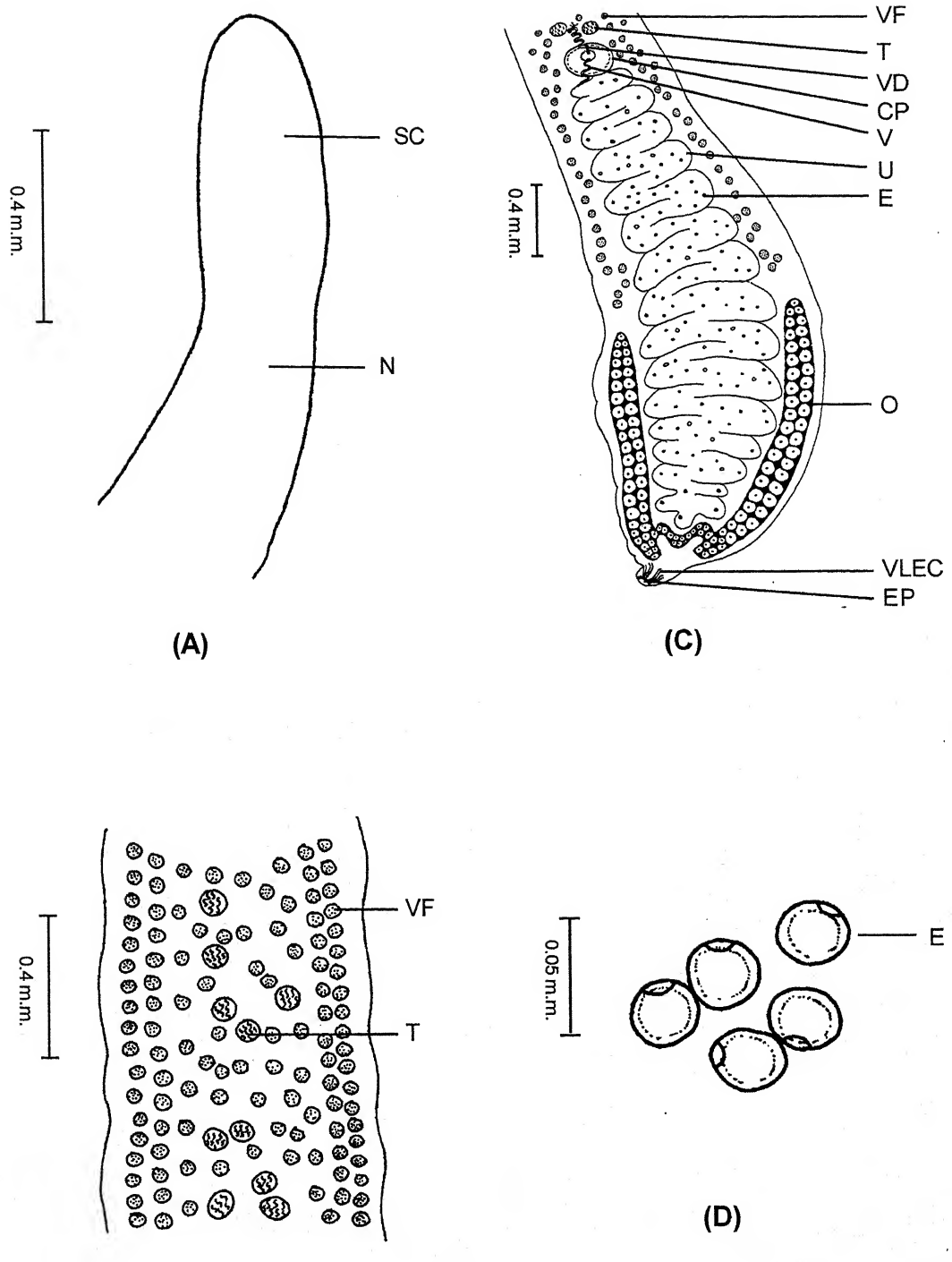

Fig. 09 : ***Sudhaena udaypali*** n.g., n.sp., A-Scolex with neck (50X), B-Middle region of the body (50X), C- Posterior region of the body (50X), D-Eggs (225X)

TABLE 09 : Comparison of the characters of two species of the genus *Sudhaena* n.g.

S. No.	Characters	*Sudhaena khurdensis* n.g.,n.sp.	*Sudhaena udaypali* n.g.,n.sp.
1	Size of worms	14.0-18.0 X 0.778-1.215	16.0-20.0 X 0.751-1.274
2	Scolex	0.541-0.597 X 0.265-0.299	0.501-0.591 X 0.230-0.277
3	Neck	2.015-2.164 X 0.234-0.262	2.261-2.792 X 0.315-0.401
4	Testes	0.051-0.065 X 0.074-0.099	0.050-0.073 X 0.074-0.099
5	Cirrus Pouch Shape Size	 Cap Shaped 0.103-0.130 X 0.440-0.501	 Oval to round 0.127-0.151 X 0.230-265
6	Internal seminal vesicle	Present	Absent
7	External seminal vesicle	Absent	Absent
8	Ovary Shape Size	 M-shaped with equal long arms 1.476-1.565 X 0.694-1.076	 M-shaped with unequal long arms 1.251-1.662 X 0.909-1.047
9	Vitellaria Position Size	 Never reaches near the level of ovary 0.037-0.056 X 0.052-0.072	 Reaches near the level of ovary 0.040-0.051 X 0.042-0.061
10	Uterus	2.54-2.87 X 0.555-0.833	2.389-2.765 X 0.505-0.765
11	Eggs Type Shape Size	 Operculate Oval to round 0.018-0.022 X 0.021-0.039	 Operculate Rounded 0.025-0.027 X 0.025-0.027
12	Host	*Heteropneustes fossilis*	*Heteropneustes fossilis*

(2.9)
Pseudobatrachus madhyapradeshensis n.sp.

Order : Caryophyllidea Beneden in Carus, 1863

Family : Capingentidae Hunter, 1930

Genus : *Pseudobatrachus* Pathak and Srivastav, 2005

Species : *Pseudobatrachus madhyapradeshensis* n.sp.

***Pseudobatrachus madhyapradeshensis* n.sp** (Fig. 10)

Six fishes, *Clarias batrachus* (Linn.) caught from Teharka, district Tikamgarh (M.P.) India, two were found infected with ten alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to the genus *Pseudobatrachus* Pathak and Srivastav, 2005 of the family Capingentidae Hunter 1930; order Caryophyllidea Beneden in Carus, 1863.

REVISED GENERIC DIAGNOSIS

Medium sized, unsegmented worms. Scolex oval to round or spoon shaped with or without groove or apical sucker or accessory suckers. Neck very long. Testes few or numerous in number, anterior to cirrus pouch, scattered in medullary parenchyma. Cirrus pouch oval to round and median. External seminal vesicle absent. Internal seminal vesicle and ejaculatory duct present or absent. Ovary H-shaped. Vitellaria partly cortical and partly medullary, reaches below the level of cirrus pouch. Postovarian vitellaria absent. Receptaculum seminis present or absent. Uterus long coiled and nonglandular. Male and female gonopores separate. Eggs oval and nonoperculate or operculate. Parasites of fresh water fishes.

***Pseudobatrachus madhyapradeshensis* n.sp.**

Medium sized, unsegmented cestodes measure 10.0-16.0 (13.0) in length and 0.340-0.501 (0.420) in width

Scolex simple, smooth and spoon shaped measures 0.404-0.453 X 0.340-0.390 (0.428 X 0.365), with single apical and two accessory suckers. Apical sucker measures 0.027-0.039 X 0.103-0.142 (0.033 X 0.122) while accessory suckers measure 0.101-0.130 X 0.037-0.047 (0.119 X 0.042). Very long neck measure 2.889-4.003 X 0.098-0.131 (3.446 X 0.114).

Testes numerous, oval to round, medullary, anterior to cirrus pouch and measure. 0.051-0.072 X 0.074-0.089 (0.061 X 0.081). Cirrus pouch oval to round and median measures 0.139-0.178 X 0.107-0.134 (0.158 X 0.120). External seminal vesicle absent. Internal seminal vesicle measures 0.043-0.057 X 0.039-

0.054 (0.050 X 0.046). Ejaculatory duct absent. Vas deferens measures 0.011-0.015 (0.013) in diameter.

Female genitalia posteriorly situated. Ovary H-shaped measures 0.580-0.681 X 0.227-0.302 (0.630 X 0.264), lateral lobes of ovary situated in cortex and medulla while isthmus in medulla.

Vitelline follicles partly cortical and partly medullary measure 0.026-0.039 X 0.026-0.042 (0.032 X 0.034), reaches below the level of cirrus pouch. Postovarian vitellaria absent. Receptaculum seminis measures 0.055-0.068 X 0.078-0.089 (0.061 X 0.083).

Uterus long, coiled and nonglandular measures 1.035-1.186 (1.110) in length and 0.189-0.244 (0.216) in width. Vagina measures 0.011-0.013 (0.012) in diameter. Male and female gonopores separately situated at the base of cirrus pouch.

Eggs oval and nonoperculate measure 0.025-0.029 X 0.033-0.044 (0.027 X 0.038). Excretory pore measure 0.018-0.031 (0.024) in diameter.

DISCUSSION

The present form comes closer to the species *Pseudobatrachus chandrai* Pathak and Srivastav, 2005.

From *Pseudobatrachus chandrai* Pathak and Srivastav, 2005 it differs in having narrower worms, smaller and spoon shaped scolex with apical and accessory suckers, absence of groove on scolex, presence of smaller and narrower neck, numerous and smaller testes, narrower cirrus pouch, presence of internal seminal vesicle, absence of ejaculatory duct, presence of smaller ovary, narrower vitellaria, presence of receptaculum seminis, narrower uterus and smaller nonoperculate eggs (Table 10).

In the light of above discussion the present form may be provisionally accommodated in the proposed new species, *Pseudobatrachus madhyapradeshensis* n. sp.

The name of the species is after the state from where hosts were collected

Host : *Clarias batrachus* (Linn)

Habitat : Intestine

Locality : Teharka, district Tikamgarh (M.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

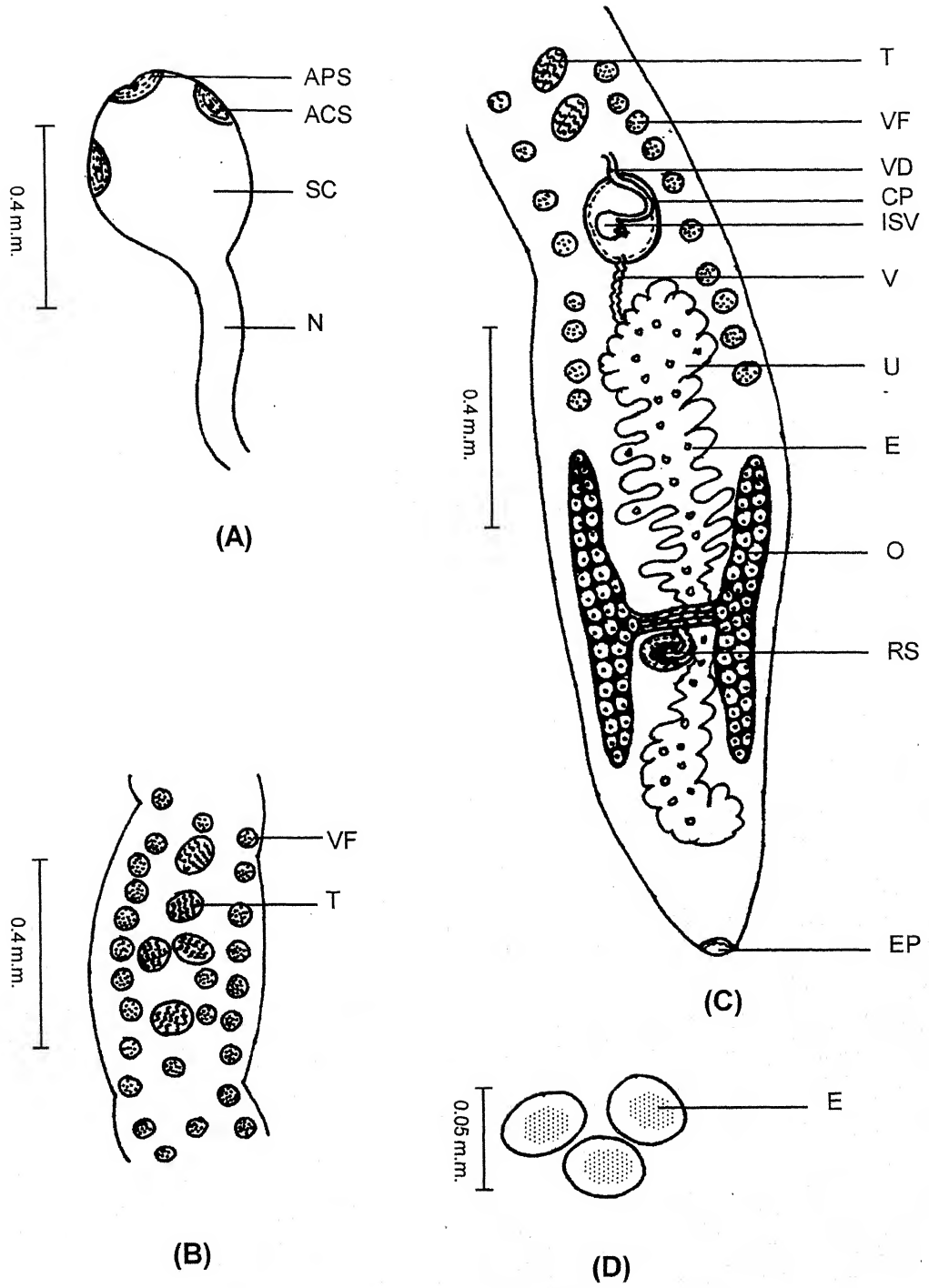

Fig. 10 : ***Pseudobatrachus madhyapradeshensis*** n.sp., A-Scolex with neck (50X), B-Middle region of the body (50X), C- Posterior region of the body (50X), D-Eggs (225X)

TABLE 10 : Comparison of the characters of the species closer to *Pseudobatrachus madhyapradeshensis* n.sp.

S. No.	Characters	*Pseudobatrachus chandrai* Pathak and Srivastav, 2005	*Pseudobatrachus madhyapradeshensis n.sp.*
1	Size of worms	6.0-20.0 X 0.9-1.056	10.0-16.0 X 0.340-0.501
2	Scolex Shape Size Apical Sucker Accessory sucker Groove	 Oval to round 0.8-1.014 X 0.256-0.514 Absent Absent Present	 Spoon-shaped 0.404-0.453 X 0.340-0.390 Present Present Absent
3	Neck	4.5-5.0 X 0.184-0.242	2.889-4.003 X 0.098-0.131
4	Testes Number Size	 5-10 0.228-0.256 X 0.228-0.328	 Numerous 0.051-0.072 X 0.074-0.089
5	Cirrus pouch	0.314-0.4 X 0.328-0.4	0.139-0.178 X 0.107-0.134
6	External seminal vesicle	Absent	Absent
7	Internal seminal vescile	Absent	Present
8	Ejaculatory duct	Present	Absent
9	Ovary Shape Size	 H-Shaped 0.642-0.8 X 0.6-0.8	 H-shaped 0.580-0.681 X 0.227-0.302
10	Vitellaria	0.070-0.128 X 0.084-0.128	0.026-0.039 X 0.026-0.042
11	Receptaculum seminis	Absent	Present
12	Uterus	1.5-1.8 X 0.114-0.556	1.035-1.186 X 0.189-0.244
13	Eggs Type Size	 Operculate 0.025-0.041 X 0.05-0.058	 Nonoperculate 0.025-0.029 X 0.033-0.044
14	Host	*Clarias batrachus*	*Clarias batrachus*

(2.10)
Heeradevina baruasagarensis
Srivastav and Khare, 2005

Order : Caryophyllidea Beneden in Carus, 1863

Family : Capingentidae Hunter, 1930

Genus : *Heeradevina* Srivastav and Khare, 2005

Species : *Heeradevina baruasagarensis* Srivastav and Khare, 2005

* ***Heeradevina baruasagarensis* Srivastav and Khare, 2005** (Fig. 11)

Ten fishes, *Clarias batrachus* (Linn) caught from Baruasagar, district Jhansi (U.P.) India, four were found infected with twenty alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to the genus, *Heeradevina* Srivastav and Khare, 2005 of the family Capingentidae Hunter, 1930; order Caryophyllidea Beneden in Carus, 1863.

GENERIC DIAGNOSIS

Medium sized, unsegmented worms with flat, smooth and blunt scolex without any groove, cushion or spines. Neck very long. Testes numerous, scattered in medullary parenchyma and anterior to cirrus pouch. Cirrus pouch oval to round and median. External and internal seminal vesicles absent. Ovary inverted A - shaped, posteriorly located, lateral lobes of ovary situated in cortex and medulla while isthmus and posterior end of ovary situated in medulla. Vitellaria partly cortical and partly medullary, reaches upto the level of cirrus pouch. Postovarian vitellaria absent. Receptaculum seminis present. Uterus long, coiled and nongladular, uterine coils not extending anterior to cirrus pouch. Eggs oval to round and nonoperculate. Parasites of fresh water fishes.

***Heeradevina baruasagarensis* Srivastav and Khare, 2005**

Cestodes medium sized and unsegmented measure 12.0-20.0 (16.0) in length

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* Published in *Flora and Fauna*, 2005 Vol. **11** No. **1** pp. 25-27.

and 0.4-0.6 (0.5) in width. Scolex flat, smooth and blunt measures 0.3-0.5 X 0.1-0.12 (0.4 X 0.11), without any additional structure like groove, cushion and spines. Very long neck measures 4.0-6.0 X 0.1-0.15 (5.0 X 0.125).

Testes numerous, oval to round measure 0.04-0.06 X 0.06-0.08 (0.05 X 0.07), scattered in medullary paranchyma, located anterior to cirrus pouch. Cirrus pouch oval to round, median measures 0.28-0.32 X 0.15-0.22 (0.30 X 0.185). External and internal seminal vesicles absent.

Female genitalia posteriorly situated. Inverted A- shaped ovary measures 0.5-0.8 X 0.4-0.5 (0.65 X 0.45), lateral lobes of ovary situated in cortex and medulla while isthmus and posterior end of ovary situated in medulla.

Vitelline follicles partly cortical and partly medullary measures 0.03-0.05 X 0.04-0.08 (0.04 X 0.06), reaches upto the level of cirrus pouch. Postovarian vitellaria absent. Receptaculum seminis measures 0.05-0.06 X 0.08-0.10 (0.55 X 0.09).

Uterus long, coiled and nonglandular measures 0.6-1.2 (0.9) in length and 0.2-0.5 (0.35) in width. Male and female gonopores separately situated near the base of cirrus pouch. Eggs oval to round and nonoperculate measure 0.005-0.008 X 0.008-0.012 (0.006 X 0.010).

DISCUSSION

The present form comes closer to the genera *Pseudocaryophyllaeus* Gupta, 1961; *Pseudoadenoscolex* Mathur and Srivastav, 1994; *Pseudobilobulata* Srivastav and Lohia, 2002 and *Pseudobatrachus* Pathak and Srivastav 2005 of the family Capingentidae Hunter, 1930; order Caryophyllidea Beneden in Carus, 1863 (Table 11).

The present form differs from *Pseudocaryophyllaeus* Gupta, 1961 in having absence of internal seminal vesicle, presence of inverted A- shaped ovary and receptaculum seminis.

From *Pseudoadenoscolex* Mathur and Srivastav, 1994 it differs in having medium sized worms, very long neck, absence of internal seminal vesicle and presence of receptaculum seminis.

From *Pseudobilobulata* Srivastav and Lohia, 2002 it differs in having very long neck, inverted A- shaped ovary and presence of receptaculum seminis.

From *Pseudobatrachus* Pathak and Srivastav, 2005 it differs in having absence of groove on scolex, presence of numerous testes, absence of ejaculatory duct, presence of inverted A- shaped ovary, receptaculum seminis and nonoperculate eggs.

Thus the proposed genus *Heeradevina* Srivastav and Khare 2005 differs from all the known genera of the family Capingentidae Hunter, 1930.

In the light of above discussion the species *Heeradevina baruasagarensis* Srivastav and Khare, 2005 has been erected.

The genus is named after eminent social worker Smt. Heera Devi Baruasagar, Jhansi (U.P.) India while the species is named after the place of host collection.

Host : *Clarias batrachus* (Linn).

Habitat : Intestine

Locality : Baruasagar, district Jhansi (U.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

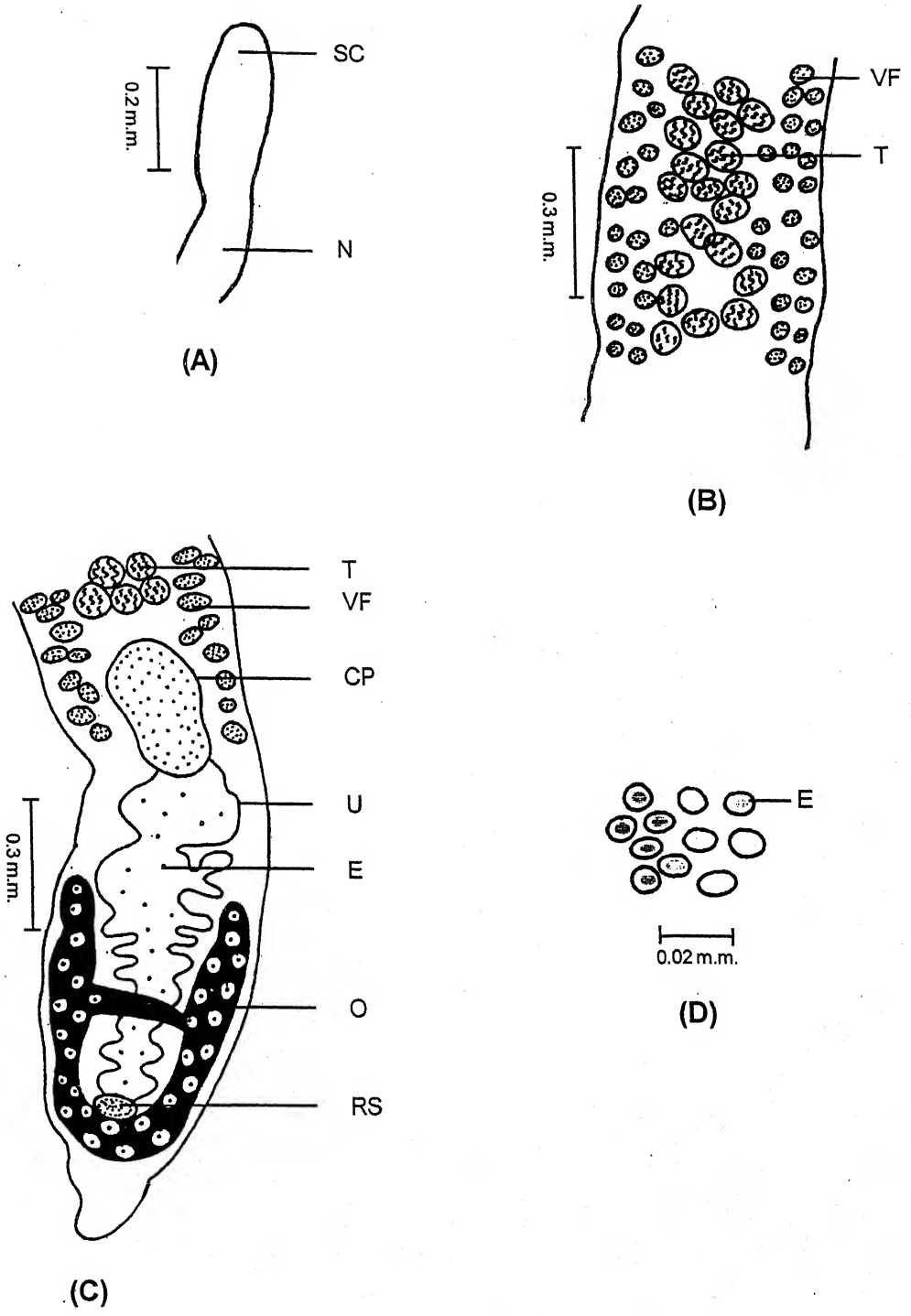

Fig. 11 : ***Heeradevina baruasagarensis*** Srivastav and Khare, 2005, A-Scolex with neck (50X), B-Middle region of the body (50X), C- Posterior region of the body (50X), D-Eggs (225X)

TABLE 11 : Comparison of the characters of the genera closer to *Heeradevina* n.g.

S. No.	Characters	*Pseudocaryophyllaeus* Gupta, 1961	*Pseudoadenoscolex* Mathur and Srivastav, 1994	*Pseudobilobulata* Srivastav and Lohia, 2002	*Pseudobatrachus* Pathak and Srivastav, 2005	*Heeradevina* Srivastav and Khare, 2005 (Present form)
1	Size of worms	–	Large	Medium	Medium	Medium
2	Groove on scolex	Absent	Absent	Absent	Present	Absent
3	Neck	Very long	Absent	Small	Very long	Very long
4	Number of testes	Numerous	Numerous	Numerous	5-10	Numerous
5	Internal seminal vesicle	Present	Preent	Absent	Absent	Absent
6	Ejaculatory duct	Absent	Absent	Absent	Present	Absent
7	Ovary	Band-shaped	Inverted A-shaped	Bilobed	H-Shaped	Inverted A-Shaped
8	Receptaculum seminis	Absent	Absent	Absent	Absent	Present
9	Eggs	Nonoperculate	Nonoperculate	Nonoperculate	Operculate	Nonoperculate

TABLE 12 : Comparison of the characters of the new genera of the family Capingentidae Hunter, 1930, described in the thesis

S.No.	Characters	*Pseudoauricularia* n.g.	*Pseudounevenata* n.g.	*Pseudoheteroinverta* Srivastav and Khare, 2005	*Sukhpatae* n.g.	*Sudhaena* n.g.	*Heeradevina* Srivastav and Khare, 2005
1	Size of worms	Medium	Medium	Medium	Medium	Medium	Medium
2	Scolex	Pointed	Blunt	Blunt	Blunt	Blunt	Blunt
3	Neck	Absent	Absent	Medium	Medium	Medium	Very long
4	Testes	Numerous	Numerous	Numerous	Numerous	Numerous	Numerous
5	Cirrus pouch	Oval to round	Oval	Oval	Oval to round	Oval to round or cap shaped	Oval to round
6	External seminal vesicle	Absent	Absent	Absent	Absent	Absent	Absent
7	Internal seminal vesicle	Absent	Present	Absent	Absent	Present or absent	Absent
8	Ovary	Ear-shaped	Uneven-bilobed	Inverted A-shaped	Omega-Shaped	M-Shaped with long arms	Inverted A-shaped
9	Vitellaria	Reaches below the level of cirrus pouch	Reaches below the level of cirrus pouch	Reaches near the ovarian arms	Reaches near the ovarian arms	Reaches below the level of cirrus pouch	Reaches upto the level of cirrus pouch
10	Receptaculum seminis	Absent	Absent	Absent	Absent	Absent	Absent
11	Eggs	Nonoperculate	Operculate	Nonoperculate	Nonoperculate	Operculate	Nonoperculate
12	Host	*Clarias batrachus*	*Clarias batrachus*	*Heteropneustes fossilis*	*Heteropneustes fossilis*	*Heteropneustes fossilis*	*Clarias batrachus*

Revised Key to the various genera of the family Capingentidae Hunter, 1930

1. Postovarian median vitellaria present ----------2
   Postovarian median vitellaria absent----------6

2. Uterine coils extend anterior to cirrus pouch, scolex with two large bothria ----------*Capingens* Hunter, 1927
   Uterine coils not extending anterior to cirrus pouch, scolex lacking botheria----------3

3. Ovary inverted A- shaped---------- *Adenoscolex* Fotedar, 1958
   Ovary not as above----------4

4. Ovary dumbbell- shaped ; scolex quite reduced; neck absent----------
   ---------- *Breviscolex* Kulakowskya, 1962
   Ovary otherwise ; scolex well developed, neck present----------5

5. Ovary H- shaped ----------*Edlintonia* Mackiewiez, 1970
   Ovary band-shaped----------*Capingentoides* Gupta, 1961

6. Ovary U- shaped, uterine coils extending anterior to cirrus pouch------
   ----------*Spartoides* Hunter, 1929
   Ovary U- shaped, uterine coils not extending anterior to cirrus pouch-
   ---------- *Mystoides* Mathur, 1992
   Ovary not U- shaped,uterine coils not extending anterior to cirrus pouch----------7

7. Neck absent----------8
   Neck present----------9

8. Ovary H-shaped---------- *Pseudolytocestus* Hunter, 1929

Ovary inverted A - shaped----------
----------*Pseudoadenoscolex* Mathur and Srivastav, 1994
Ovary fan-shaped---------- *Pseudoclariasis* Pathak, 2002
Ovary inverted U- shaped---------- *Pseudoinverta* Pathak, 2002
Ovary ear - shaped---------- *Pseudoauricularia* n.g.
Ovary uneven bilobed----------*Pseudounevenata* n.g.

9. Neck small, ovary-bilobed----------
----------*Pseudobilobulata* Srivastav and Lohia, 2002

Neck Medium, ovary inverted A- shaped ----------
----------*Pseudoheteroinverta* Srivastav and Khare, 2005
Neck medium, ovary omega-shaped---------- *Sukhpatae* n.g.
Neck medium ovary M-shaped with long arms----------*Sudhaena* n.g.

Very long neck, ovary band-shaped----------
----------*Pseudocaryophyllaeus* Gupta, 1961
Very long neck, ovary H-shaped----------
----------*Pseudobatrachus* Pathak and Srivastav, 2005
Very long neck, ovary inverted A-shaped----------
----------*Heeradevina* Srivastav and Khare, 2005

(3.1)
Circumonchobothrium (Postovilata) betwaensis n.subg., n.sp.

Order : Pseudophyllidea Carus, 1863

Family : Ptychobothriidae Luhe, 1902

Genus : *Circumonchobothrium* Shinde, 1968

Subgenus : *Circumonchobothrium* (*Postovilata*) n. subg.

Species : *Circumonchobothrium (Postovilata) betwaensis* n. subg., n. sp.

***Circumonchobothrium (Postovilata) betwaensis* n. subg., n. sp.** (Fig. 12) Two hundred forty fishes, *Mastacembelus armatus* (Lacepede) caught from Betwa river, district Jhansi (U.P.) India, five were found infected with eight alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to a new subgenus *Circumonchobothrium* (*Postovilata*) n. subg. of the genus *Circumonchobothrium* Shinde, 1968 of the family Ptychobothriidae Luhe, 1902; order Pseudophyllidea Carus, 1863.

SUBGENERIC DIAGNOSIS

Large sized, segmented worms. Scolex with two sac like bothria. Rostellum bears a single, continuous circle of hooks. Neck present. Proglottids broader than long. Testes partly cortical and partly medullary, arranged in two lateral fields, cirrus pouch weak. External and internal seminal vesicles absent. Ovary bilobed, medial and postequatorial. Receptaculum seminis present. Vitelline gland single, compact and postovarian. Genital atrium medial. Eggs oval to round and nonoperculate. Parasites of fresh water fishes.

Circumonchobothrium (Postovilata) betwaensis n.subg.,n.sp.

Cestodes large sized and segmented measure 90.0-220.0 X 1.3-1.5 (155.0 X 1.4). Scolex well developed measures 1.0-1.15 X 0.625-0.751 (1.075 X 0.688), narrow anteriorly and broad posteriorly. Bothria sac like measure 0.675-0.937 X 0.24-0.312 (0.806 X 0.276). Rostellum cap like

measures 0.15-0.20 X 0.18-0.22 (0.175 X 0.2). Rostellar hooks 30-32 in number, present in a single complete circle and variable in size. Smaller rostellar hooks measure 0.027-0.036 (0.031) in length while larger 0.048-0.063 (0.055). Neck small measures 0.125-0.168 X 0.22-0.25 (0.146 X 0.235).

Proglottids broader than long. Immature proglottids craspedote while mature and gravid proglottids acraspedote. Immature proglottids measure 0.15-0.35 X 0.187- 0.375 (0.25 X 0.281). Mature proglottids measure 0.187-0.437 X 0.75-1.5 (0.312 X 1.125) and gravid proglottids measure 0.312-0.437 X 0.125-1.5 (0.374 X 1.375).

Testes partly cortical, partly medullary, 180-340 in number measure 0.022-0.052 X 0.025-0.05 (0.037 X 0.037), in two lateral fields which separate anteriorly but touches posteriorly. Cirrus pouch weakly developed measures 0.026-0.062 X 0.029-0.066 (0.044 X 0.047). External and internal seminal vesicles absent.

Ovary bilobed, medial and postequatorial measures 0.06-0.125 X 0.20-0.525 (0.092 X 0.362). Vagina measures 0.006-0.015 (0.010) in diameter, opens laterally into genital atrium. Receptaculum seminis measures 0.009-0.016 X 0.036-0.06 (0.012 X 0.048).

Vitelline gland single, compact and postovarian measures 0.012 - 0.018 X 0.05-0.22 (0.015 X 0.135). Genital atrium medial measures 0.024 - 0.033x0.027-0.039 (0.028 X 0.033) in deep and wide respectively.

Uterus coiled in mature proglottids and sac like in gravid proglottids measures 0.187-0.3 X 0.162-0.425 (0.243 X 0.293).

Eggs oval to round and nonoperculate measure 0.018-0.033 X 0.021-0.039 (0.025 X 0.033). Ventral longitudinal excretory canals measure 0.011-0.025 (0.018) in diameter.

DISCUSSION

The present form comes closer to the genus *Circumonchobothrium* Shinde, 1968 of the family Ptychothriidae Luhe, 1902.

The present form differs from *Circumonchobothrium* Shinde, 1968 in having sac like bothria, presence of neck and single postovarian vitelline gland (Table 13).

Hence genus *Circumonchobothrium* Shinde, 1968 is divided into two subgenera Viz. *Circumonchobothrium* (*Circumoncholothrium*) n. subg. and *circumonchonbothrium (Postovilata)* n. subg. on the basis of vitellaria.

In the light of above discussion the species *Circumonchobothrium (Postovilata) betwaensis* n. subg., n. sp. may be provisionally accommodated in the proposed new subgenus.

The name of the species is after the river from where the hosts were collected.

Host : *Mastacembelus armatus* (Lacepedes)

Habitat : Intestine

Locality : Betwa river, district Jhansi (U.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

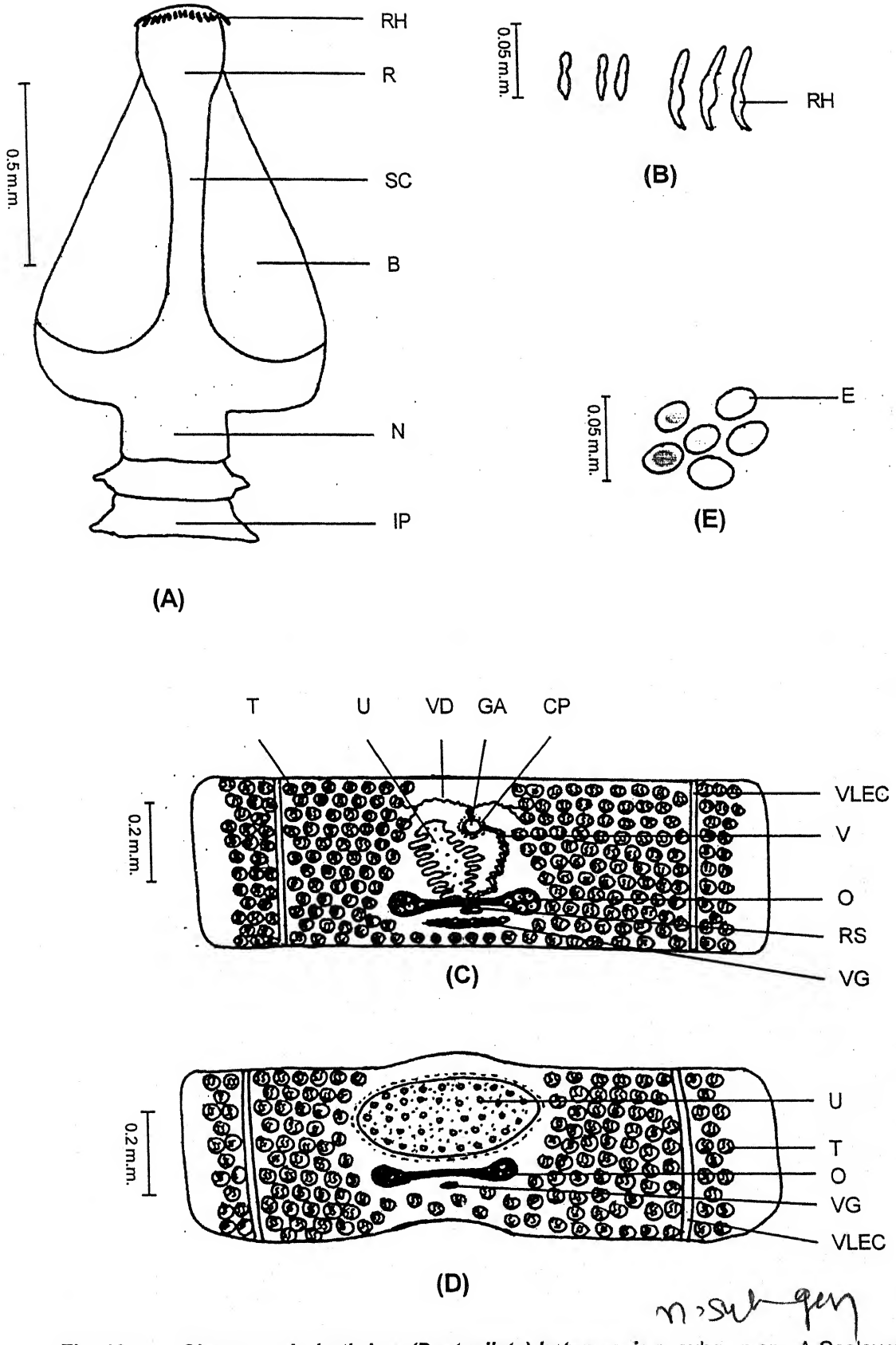

Fig. 12 : ***Circumonchobothrium (Postovilata) betwaensis*** n. subg., n.sp., A-Scolex with neck and immatue proglottids (50X), B-*Rostellar hooks (225X)*, C- Mature proglattids (50X), D-Gravid proglottids (50X), E-Eggs (225X)

TABLE 13 : Differences between *Circumonchobothrium* Shinde, 1968 and *Circumonchobothrium (Postovilata) n. subg.*

S.No.	Characters	*Circumonchobothrium* Shinde, 1968	*Circumonchobothrium (Postovilata)* n. subg.
1	Bothria	Shallow	Sac- like
2	Neck	Absent	Present
3	Vitelline gland	In the form of numerous, lateral follicles	Single, Postovarian

Kew to the new subgenera of the genus *Circumonchobothrium* Shinde, 1968 of the family Ptychobothriidae Luhe, 1902; order Pseudophyllidea Carus, 1868

1a. Vitellaria, numerous and lateral----------
----------*Circumonchobothrium* (*Circumonchobothrium*) n. subg.

1b. Vitelline gland, single and postovarian----------
----------*Circumonchobothrium (Postovilata)* n. subg.

(3.2)
Senga tictoi
n.sp.

Order : Pseudophyllidea Carus, 1863

Family : Ptychobothriidae, Luhe, 1902

Genus : *Senga* Dollfus, 1934

Species : *Senga tictoi* n. sp.

***Senga tictoi* n.sp.** (Fig. 13)

Seventeen fishes, *Puntius ticto* (Ham.) caught from Jhansi (U.P.) India, five were found infected with six alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to the genus *Senga* Dollfus, 1934 of the family Ptychobothriidae, Luhe, 1902; order Pseudophyllidea Carus, 1863.

Cestodes medium, segmented and measure 22.0-32.0 X 0.552-0.755 (27.0 X 0.653). Scolex oval, narrow at both ends measures 0.474-0.565 X 0.401-0.418 (0.519 X 0.409). Rostellum bilobed measures 0.045-0.061 X 0.151 0.186 (0.053 X 0.168). Rostellar hooks 24-28 in number measure 0.042-0.054 (0.048) in length. Handle of hook comparatively long, blade medium and guard small. Bothria elongated, deep measure 0.452-0.487 X 0.066 - 0.077 (0.469 X 0.071). Neck absent.

Proglottids broader than long and craspedote. Immature proglottids measure 0.077-0.091 X 0.355-0.377 (0.084 X 0.366). Mature proglottids 0.251-0.312 X 0.552-0.672 (0.281 X 0.612) and gravid proglottids 0.315-0.437 X 0.655-0.775 (0.376 X 0.705).

Testes oval to round, 60-120 in number measure 0.020-0.026 X 0.027-0.038 (0.023 X 0.032), scattered throughout the medulla. Cirrus pouch bounded by thin membrane and measures 0.036-0.037 X 0.037-0.041 (0.036 X 0.039). External and internal seminal vesicles absent.

Ovary bilobed, medial, posteriorly located and measures 0.063-0.103 X 0.212-0.345 (0.083 X 0.278). Vagina measures 0.006-0.007 (0.007) in diameter, opens laterally into genital atrium. Receptaculum seminis absent.

Vitelline follicles innumerable, cortical measure 0.012-0.015 X 0.018-0.026 (0.0130.022), in two lateral bands. Genital pore medial measures 0.026-0.028 (0.027) in diameter.

Uterus median, sac like and measures 0.075-0.244 X 0.076-0.277 (0.159 X 0.176).

Eggs oval, operculate measure 0.020-0.023 X 0.030 - 0.033 (0.021 X 0.031).

DISCUSSION

The present form comes closer to *Senga khami* Shinde and Deshmukh, 1980; *Senga punctati* Gupta and Sinha, 1980; *Senga mastacembali* Gupta and Sinha, 1980; *Senga indica* Gupta and Parmar, 1985 and *Senga jhansiensis* Mathur, Srivastav and Daisy Rani, 1994 (Table 14).

The present form differs from *Senga khami* Shinde and Deshmukh, 1980 in having smaller worms, smaller but broader scolex, smaller bothria, lesser number of rostellar hooks, absence of neck, smaller mature proglottids and narrower ovary.

From *Senga punctati* Gupta and Sinha, 1980 it differs in having smaller worms, smaller scolex, smaller bothria, lesser number of rostellar hooks, smaller mature proglottids, smaller gravid proglottids and wider ovary.

From *Senga mastacembali* Gupta and Sinha, 1980 it differs in having smaller worms, smaller scolex, smaller bothria, lesser number of rostellar

hooks, narrower mature proglottids, larger but narrower gravid proglottids and wider ovary.

From *Senga indica* Gupta and Parmar, 1985 it differs in having smaller worms, smaller scolex, smaller bothria, lesser number of rostellar hooks, smaller but broader mature proglottids, smaller but broader gravid proglottids and wider ovary.

From *Senga jhansiensis* Mathur, Srivastav and Daisy Rani, 1994 it differs in having smaller worms, smaller scolex, smaller bothria, lesser number of rostellar hooks, absence of neck, narrower mature proglottids, narrower gravid proglottids and smaller ovary.

In the light of above discussion the species *Senga tictoi* n. sp. may be provisionally accommodated as a new species.

The name of the species is after the host.

Host : *Puntius ticto* (Ham.)

Habitat : Intestine

Locality : Jhansi (U.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

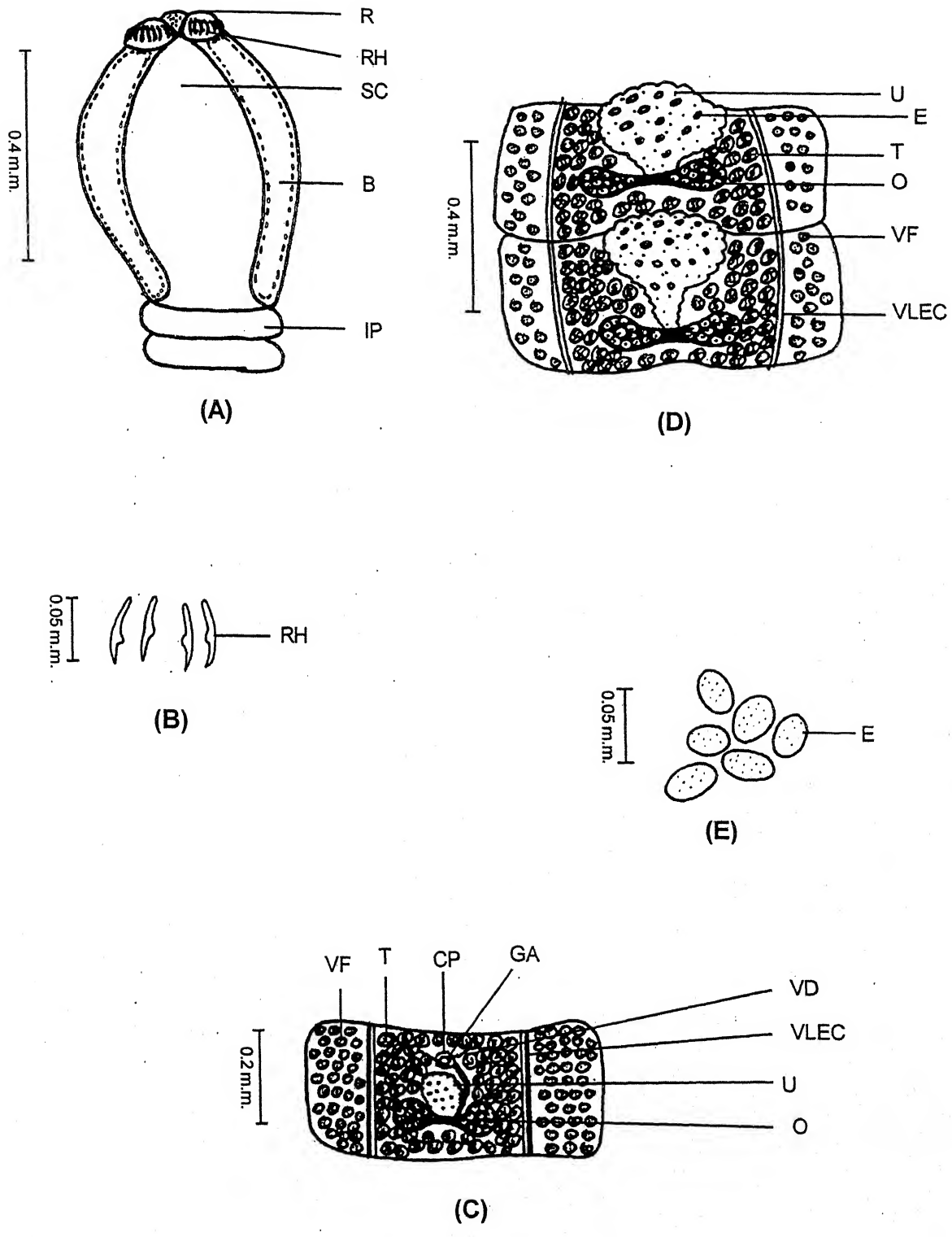

Fig. 13 : ***Senga tictoi*** n.sp., A-Scolex with Immature proglottids (50X), B-Rostellar hooks (225X), C- Mature proglottid (50X), D-Gravid proglottids (50X), E- Eggs (225X)

TABLE 14 : Comparison of the characters of the species closer to *Senga tictoi* n.sp.

S. No.	Characters	*Senga khami* Shinde and Deshmukh, 1980	*Senga punctati* Gupta and Sinha, 1980	*Senga mastacembali* Gupta and Sinha, 1980	*Senga indica* Gupta and Parmar, 1985	*Senga jhansiensis* Mathur, Srivastav and Daisy Rani, 1994	*Senga tictoi* n.sp.
1	Size of worms	126.0x1.94	150.0 -180.0 X 1.20-1.49	180.0-200.0 X 1.2-1.38	176.0 X 1.32	110.0-125.0 X 0.98-1.23	22.0-32.0 X 0.552-0.755
2	Scolex	1.13-1.21 X 0.37-0.39	0.76-0.78 in length	0.92-0.99 in length	0.78 X 0.62	0.98-1.4 X 0.23-0.61	0.474-0.565 X 0.401-0.418
3	Bothria	0.65 X 0.22	0.55-0.58 in length	0.79-0.80 in length	0.62 in length	1.11-1.23 X 0.001-0.32	0.452-0.487 X 0.066-0.077
4	Number of Rostellar hooks	55-57	28-30	30-36	36	28-32	24-28
5	Neck	Present	Absent	Absent	Absent	Present	Absent
6	Mature Proglottids	1.36 X 1.94	1.42-1.46 X 0.062-0.064	0.235-0.23 X 0.85-0.89	1.86 X 0.44	0.26-0.49 X 0.78-1.23	0.251-0.312 X 0.552-0.672
7	Gravid Proglottids	-	1.21-1.31 X 0.56-0.60	0.293-0.310 X 0.89-0.895	1.58 X 0.26	0.39-0.58 X 0.78-1.23	0.315-0.437 X 0.655-0.755
8	Ovary	0.73 X 0.35-0.39	0.17 - 0.19 X 0.05-0.055	0.06-0.07 X 0.05-0.55	0.18 X 0.16	0.013-0.21 X 0.196-0.39	0.063-0.103 X 0.212-0.345

(4.1)
Philobythos (Armata) gambhirii
n.subg., n.sp.

Order : Pseudophyllidea Carus, 1863

Family : Philobythiidae Campbell, 1977

Genus : *Philobythos* Campbell, 1977

Subgenus : *Philobythos (Armata)* n. subg.

Species : *Philobythos (Armata) gambhirii* n. subg., n. sp.

***Philobythos (Armata) gambhirii* n. subg., n.sp.** (Fig. 14)

Eight fishes, *Channa striatus* (Bloch) caught from Baruasagar, district Jhansi (U.P.) India, three were found infected with four alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to a new subgenus *Philobythos (Armata)* n. subg. of the genus *Philobythos* Campbell, 1977 of the family Philobythiidae Campbell, 1977; order Pseudophyllidea Carus, 1863.

SUBGENERIC DIAGNOSIS

Large sized, segmented worms. Scolex elongated with armed apical disc and two elongated shallow bothria. Neck small or very long. Proglottids craspedote, broader than long. Testes medullary, arranged in two or four lateral fields. Some testes postovarian. Cirrus pouch marginal or submarginal. Cirrus unarmed. External seminal vesicle present or absent. Internal seminal vesicle absent. Ovary bilobed, medullary, medial and postequatorial. Receptaculum seminis present or absent. Vitellarium single, lobate, transeversely elongated and postovarian. Genital atrium irregularly alternating. Uterus medial and coiled. Eggs oval and operculate. Parasites of fresh water fishes.

***Philobythos (Armata) gambhirii* n. subg., n. sp.**

Cestodes large, segmented measure 25.0-65.0 x 1.062-1.262 (45.0 x 1.162). Scolex elongated, broad anteriorly and narrow posteriorly measures 0.487-

0.626 X 0.175-0.225 (0.556 X 0.02). Apical disc armed and rounded measure 0.053-0.075 X 0.114-0.175 (0.064 X 0.144). Rostellar hooks in a single row, 32-40 in number measure 0.030-0.060 (0.045) in length. Bothria elongated, shallow, two in number and measure 0.412-0.534 X 0.047-0.062 (0.473 X 0.054). Neck very long measures 3.513-4.182 X 0.112-0.132 (3.847 X 0.122).

Proglottids numerous, broader than long and craspedate. Immature proglottids measure 0.092-0.212 X 0.251-0.425 (0.152 X 0.338). Mature proglottids 0.215-0.312 X 0.755-1.062 (0.263 X 0.908) and gravid proglottids 0.152-0.285 X 0.882-1.262 (0.218 X 1.072).

Testes medullary, 20-40 in number measure 0.041-0.052 X 0.035 - 0.062 (0.046 X 0.048), arranged in two lateral fields. Some testes postovarian. Cirrus pouch marginal, oval, slightly oblique and measures 0.022-0.037 X 0.072 - 0.081 (0.029 X 0.076). Cirrus unarmed. External and internal seminal vesicles absent.

Ovary bilobed, medullary, medial, postequatorial and measures 0.057-0.086 X 0.225-0.35 (0.071 X 0.287). Vagina 0.008-0.015 (0.013) in diameter, anterior to cirrus pouch. Receptaculum seminis measures 0.012-0.018 X 0.021-0.032 (0.015 X 0.026). Vitelline gland single, lobate, transeversely elongated, postovarian and measures 0.026-0.035 X 0.055-0.081 (0.030 X 0.068). Genital atrium irregularly alternating measures 0.006-0.014 X 0.006-0.014 (0.01 X 0.01) in deep and wide respectively.

Uterus medial, coiled measures 0.176-0.201 (0.188) in length and 0.214-0.275 (0.244) in width. Uterine pore posterior measures 0.022-0.037 (0.029) in diameter.

Eggs oval, operculate measure 0.012-0.016 X 0.018-0.030 (0.014 X 0.024). Ventral longitudinal excretory canals measure 0.012-0.019 (0.015) in diameter.

DISCUSSION

The present form comes closer to the genus *Philobythos* Campbell, 1977.

The present form differs from *Philobythos* Campbell, 1977 in having armed scolex, well developed apical disc, presence of testes in two or four lateral fields, irregularly alternating genital atrium and coiled uterus without lateral diverticula (Table 15).

Thus the proposed new subgenus *Philobythos (Armata)* n. subg. differs from the genus *Philobythos* Campbell, 1977.

Hence the genus *Philobythos* Campbell, 1977 is divided into two subgenera Viz. *Philobythos (Philobythos)* n. subg. and *Philobythos (Armata)* n. subg. on the basis of rostellar hooks.

In the light of above discussion the species *Philobythos (Armata) gambhirii* n. subg., n. sp. may be provisionally accommodated in the proposed new subgenus.

The species is named after famous parasitologist Prof. R.K. Gambhir, Manipur University, Canchipur (Manipur) India.

Host : *Channa striatus* (Bloch)

Habitat : Intestine

Locality : Baruasagar, district Jhansi (U.P.) India

Hoilotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

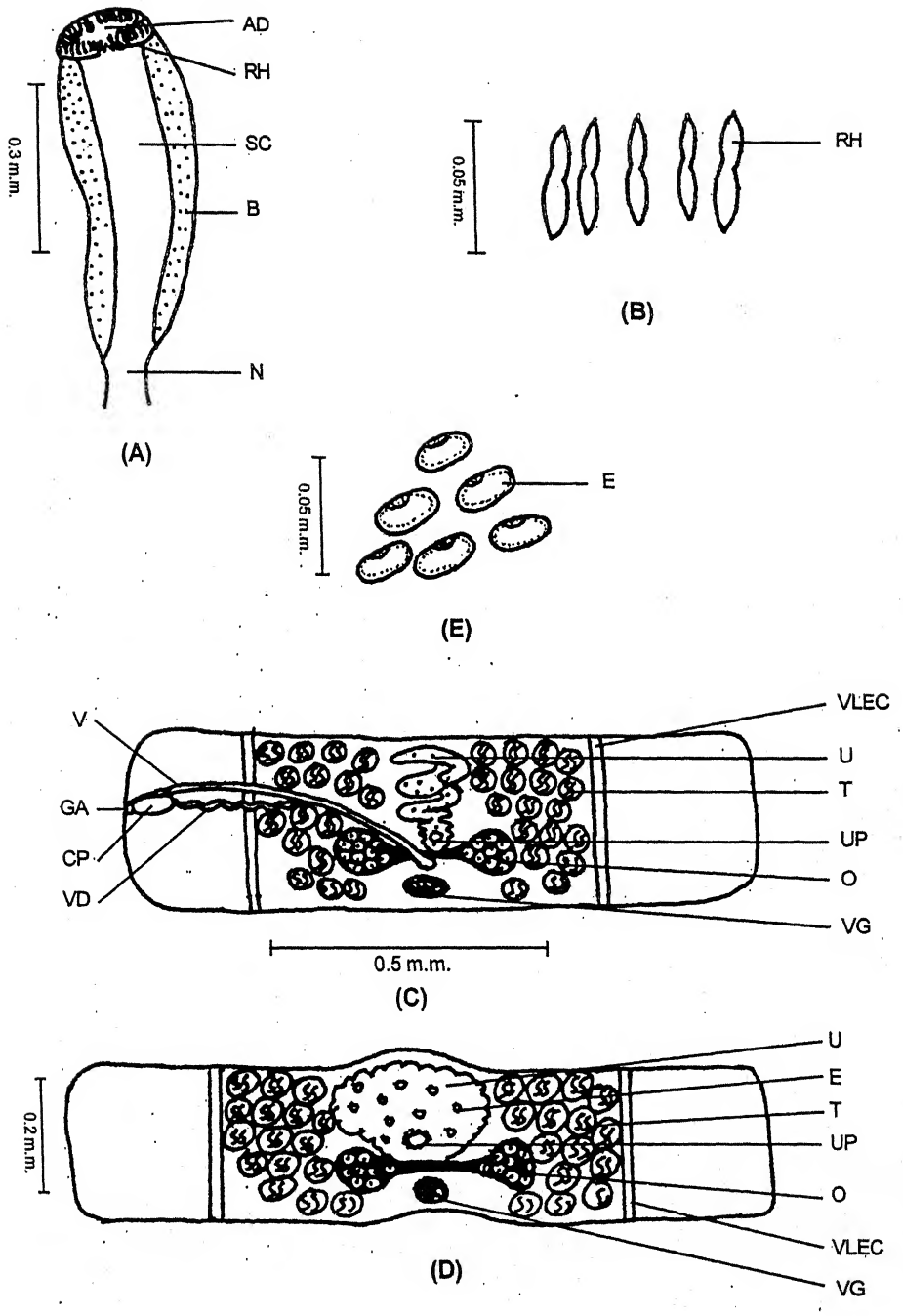

Fig. 14 : ***Philobythos (Armata) gambhirii*** n. subg., n.sp., A-Scolex with neck (50X), B-Rostellar hooks (225X), C- Mature proglottid (50X), D-Gravid proglottid (50X), E- Eggs (225X)

TABLE 15 : Differences between *Philobythos* Campbell, 1977 and *Philobythos (Armata)* n. subg.

S. No.	Characters	*Philobythos* Campbell, 1977	*Philobythos (Armata)* n. subg.
1	Scolex	Unarmed	Armed
2	Apical disc	Weakly develope	Well develope
3	Testes	Scattered	Present in two or four lateral fields
4	Genital atrium	Unilateral	Irregularly alternating
5	Uterus	Triangular with lateral diverticula	Coiled without lateral diverticula

(4.2)
Philobythos (Armata) bifurcatum
n.subg., n.sp.

Order : Pseudophyllidea Carus, 1863

Family : Philobythiidae Campbell, 1977

Genus : *Philobythos* Campbell, 1977

Subgenus : *Philobythos (Armata)* n. subg.

Species : *Philobythos (Armata) bifurcatum* n. subg., n.sp.

***Philobythos (Armata) bifurcatum* n. subg., n. sp.** (Fig. 15)

Four fishes, *Channa striatus* (Bloch) caught from Prithvipur, district Tikamgarh (M.P.) India, two were found infected with three alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to a new subgenus *Philobythos (Armata)* n. subg. of the genus *Philobythos* Campbell, 1977 of the family Philobythiidae Campbell, 1977, order Pseudophyllidea Carus, 1863.

Cestodes large, segmented measure 80.0-120.0 X 1.125-1.651 (100.0 X 1.388). Scolex elongated, rectangular measures 0.7-0.985 X 0.0342-0.405 (0.842 X 0.373). Apical disc armed, bifid measures 0.15-0.2 X 0. 3-0. 35 (0.175 X 0.325). Rostellar hooks 36-44 in number, arranged in two circular rings measure 0.045-0.060 (0.052) in length. Bothria elongated, shallow, two in number measure 0.62-0.72 X 0.12-0.15 (0.67 X 0.135). Neck small measures 0.625-1.002 X 0.125 - 0.201 (0.813 X 0.163).

Proglottids numerous, broader than long and craspedote. Immature proglottids measure 0.125-0.251 X 0.252-0.375 (0.188 X 0.313). Mature proglottids 0.262-0.387 X 0.725-1.125 (0.324 X 0.925) and gravid proglottids 0.312-0.475 X 1.105-1.651 (0.393 X 1.378).

Testes medullary, 56-80 in number measure 0.022-0.031 X 0.031-0.052 (0.026 X 0.041), arranged in four lateral fields. Some testes postovarian. Cirrus pouch submarginal, oval, transeversely oblique and measures 0.042-0.052 X 0.043-0.085 (0.047 X 0.064). Cirrus unarmed.

External seminal vesicle measures 0.015-0.031 X 0.041-0.065 (0.023 X 0.053). Internal seminal vesicle absent.

Ovary bilobed, medullary, medial, postequatorial and measures 0.041-0.075 X 0.275-0.352 (0.058 X 0.313). Vagina 0.006-0.011 (0.008) in diameter, posterior to cirrus pouch. Receptaculum seminis absent.

Vitelline gland single, lobate, transeversely elongated, postovarian and measures 0.027-0.042 X 0.043-0.057 (0.034 X 0.05). Genital atrium irregulary alternating measures 0.025-0.037 X 0.011-0.014 (0.031 X 0.012) in deep and wide respectively.

Uterus medial, coiled and measures 0.152-0.325 X 0.152-0.487 (0.238 X 0.319).

Eggs oval, operculate and measure 0.024-0.030 X 0.031-0.041 (0.027 X 0.036). Ventral longitudinal excretory canals measure 0.012-0.015 (0.013) in diameter.

DISCUSSION

The present form comes closer to the species *Philobythos (Armata) gambhirii* n. subg., n. sp.

The present form differs from *Philobythos (Armata) gambhirii* n. subg., n. sp. in having larger worms, greater number of rostellar hooks, larger bothria, smaller neck, larger proglottids, greater number of testes in four lateral fields, submarginal cirrus pouch, presence of external seminal vesicle, differently situated vagina and absence of receptaculum seminis (Table 16).

In the light of above discussion it may be provisionally proposed to accommodate the present form as a new species *Philobythos (Armata) bifurcatum* n. subg., n. sp.

Host : *Channa striatus* (Bloch)

Habitat : Intestine

Locality : Prithvipur, district Tikamgarh (M.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhanis (U.P.) India.

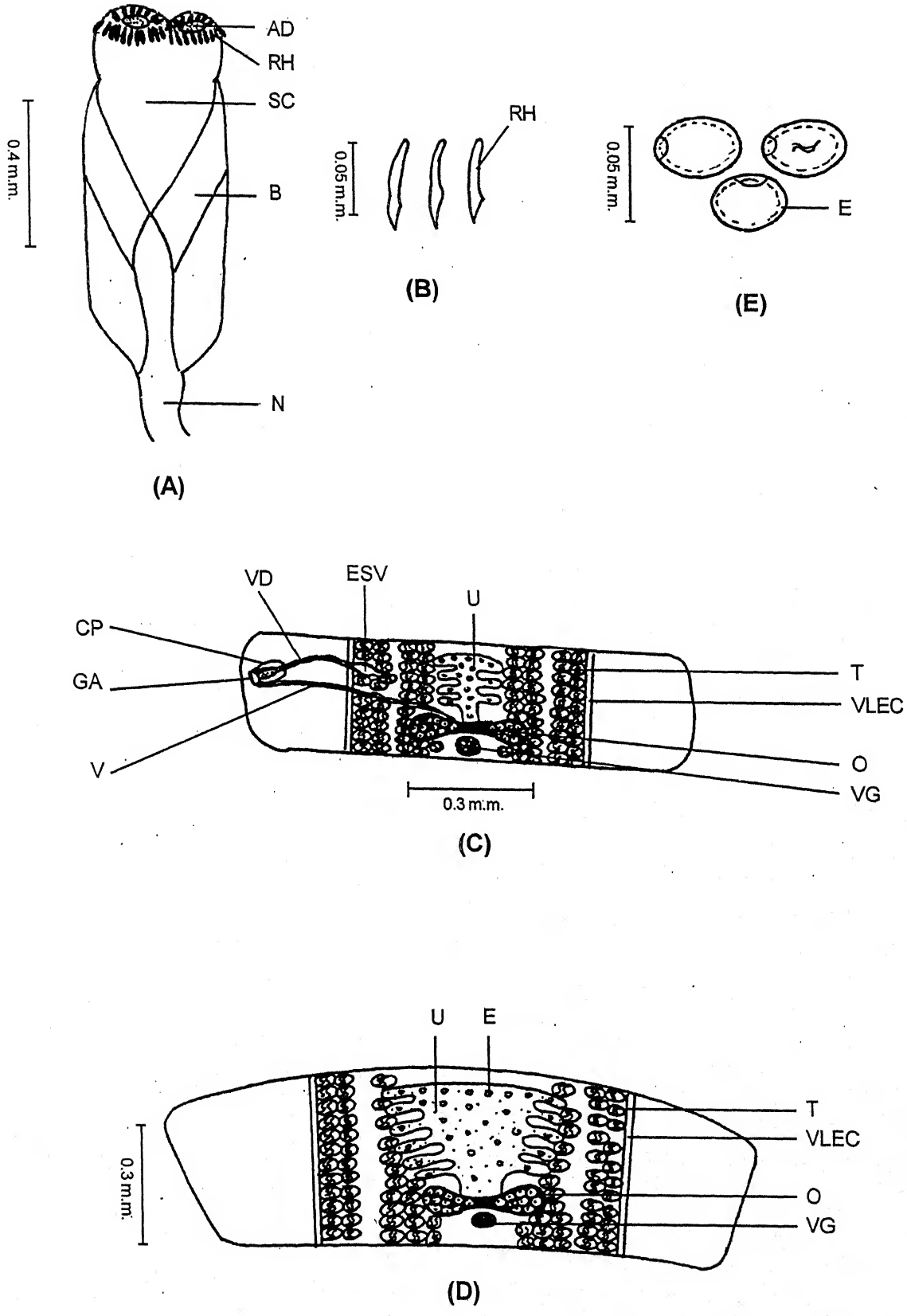

Fig. 15 : ***Philobythos (Armata) bifurcatum*** n. subg., n.sp., A- Scolex with neck (50X), B- Rostellar hooks (225X), C- Mature proglottid (50X), D-Gravid proglottid (50X), E- Eggs (225X)

TABLE 16 : Comparison of the characters of the species closer to *Philobythos* (*Armata*) *bifurcatum* n. subg., n.sp.

S.No.	Characters	*Philobythos (Armata) gambhirii* n. subg., n.sp.	*Philobythos (Armata) bifurcatum* n. subg., n.sp
1	Size of worms	25.0-65.0 X 1.062-1.262	80.0-120.0 X 1.125-1.651
2	Scolex	0.487-0.626 X 0.175-0.215	0.7-0.985 X 0.342-0.405
3	Apical disc	Simple rounded	Bifid
4	Rostellar hooks	32-40	36-44
5	Bothria	0.412-0.534 X 0.047-0.062	0.62-0.72 X 0.12-0.15
6	Neck	Very long	Small
7	Proglottids		
	Immature	0.092-0.212 X 0.251-0.425	0.125-0.251 X 0.252-0.375
	Mature	0.215-0.312 X 0.755-1.062	0.262-0.387 X 0.725-1.125
	Gravid	0.152-0.285 X 0.882-1.262	0.312-0.475 X 1.105-1.651
8	Testes		
	Number	20-40	56-80
	Arrangement	In two lateral fields	In Four lateral fields
9	Cirrus pouch	Marginal	Submarginal
10	External seminal vesicle	Absent	Present
11	Internal seminal vesicle	Absent	Absent
12	Ovary	Bilobed	Bilobed
13	Vagina	Anterior to cirrus pouch	Posterior to cirrus pouch
14	Receptaculum seminis	Present	Absent
15	Genital atrium	Irregularly alternating	Irregularly alternating
16	Eggs	Operculate	Operculate

Key to the new subgenera of the genus *Philobythos* Campbell, 1977 of the family Philobythiidae Campbell, 1977; order Pseudophyllidea Carus 1863.

1a- Scolex with unarmed apical disc.....
.....*Philobythos (Philobythos)* n. subg.

1b- Scolex with armed apical disc.....
.....*Philobythos (Armata)* n. subg.

(5.1)
Dactylobothrium choprai
n.g., n.sp.

Order : Pseudophyllidea Carus, 1863

Family : Parabothriocephalidae Yamaguti, 1959

Genus : *Dactylobothrium* n.g.

Species : *Dactylobothrium choprai* n.g.,n.sp.

***Dactylobothrium choprai* n.g., n.sp.** (Fig. 16)

Ten fishes, *Channa punctatus* (Bloch) caught from Prithvipur, district Tikamgarh (M.P.) India, three were found infected with four alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to a new genus *Dactylobothrium* n.g. of the family Parabothriocephalidae Yamaguti, 1959; order Pseudophyllidea Carus, 1863.

GENERIC DIAGNOSIS

Medium sized, segmented worms. Scolex with two elongated bothria. Apical disc armed. Rostellar hooks present in four rows. Neck absent. Proglottids craspedote mainly broader than long. Testes medullary, arranged in two lateral fields. Cirrus pouch marginal. External and internal seminal vesicles absent. Ovary bilobed, medial and postequatorial. Vagina anterior to cirrus pouch. Receptaculum seminis of different proglottids connected by a mid duct. Vitellaria cortical. Genital atrium unilateral. Uterus coiled. Uterine pore anterior. Eggs oval and operculate. Parasites of fresh water fishes.

***Dactylobothrium choprai* n.g. n.sp.**

Cestodes medium sized measure 22.0-54.0 X 0.824-0.951 (38.0 X 0.887). Scolex broad anteriorly and narrow posteriorly measures 0.376-0.550 X 0.176-0.283 (0.463 X 0.229). Apical disc armed measures 0.062-0.089 X 0.164-0.233 (0.075 X 0.198). Rostellar hooks present in four rows. Anterior three rows bear small, numerous hooks and measure 0.004-0.007 (0.005) in length. Fourth row contains larger hooks, 28-36 in number and

measure 0.036-0.045 (0.040) in length, arranged in two groups. Bothria, shallow measure 0.315-0.441 X 0.042-0.076 (0.378 X 0.059). Neck absent.

Proglottids craspedote. Immature proglottids longer than broad while mature and gravid proglottids broader than long. Immature proglottids measure 0.187-0.376 X 0.168-0.203 (0.281 X 0.185). Mature proglottids, 0.192-0.315 X 0.479-0.824 (0.252 X 0.653) and gravid proglottids, 0.176-0.362 X 0.751-0.951 (0.269 X 0.851).

Testes medullary, 28-52 in number measure 0.026-0.047 X 0.028-0.049 (0.036 X 0.038), in two lateral fields which never crosses ventral longitudinal excretory canals. Cirrus pouch marginal, oval, transeversely oblique measures 0.058-0.074 X 0.039-0.047 (0.066 X 0.043). External and internal seminal vesicles absent. Vas deferens measures 0.001-0.006 (0.003) in diameter.

Ovary bilobed, medial, postequatorial measures 0.062-0.087 X 0.201-0.296 (0.074 X 0.248). Vagina measures 0.012-0.014 (0.013) in diameter, anterior to cirrus pouch. Receptaculum seminis preovarian measures 0.037-0.050 X 0.040-0.057 (0.043 X 0.048). Receptaculum seminis of different proglottids connected by a mid duct.

Vitelline follicles cortical measure 0.008-0.012 X 0.006-0.015 (0.010 X 0.011), in two lateral bands. Genital atrium unilateral measures 0.022-0.039 X 0.004-0.012 (0.030 X 0.008) in deep and wide respectively.

Uterus coiled, medial measures 0.105-0.345 X 0.051-0.112 (0.225 X 0.081). Uterine pore anteriorly located measures 0.011-0.013 (0.012) in diameter.

Eggs oval, operculate measure 0.018-0.024 X 0.028-0.034 (0.021 X 0.031). Ventral longitudinal excretory canals measure 0.011-0.012 (0.011) in diameter.

DISCUSSION

The present form comes closer to the genus *Glossobothrium* Yamaguti, 1952 of the family Parabothriocephalidae Yamaguti, 1959.

The present form differs from *Glossobothrium* Yamaguti, 1952 in having armed apical disc, absence of bothrial appendages, presence of medial ovary, unilateral genital atrium, presence of mid duct and differently shaped uterus (Table 17).

Thus the present form differs from all the known genera of the family Parabothriocephalidae Yamaguti, 1959.

In the light of above discussion the species *Dactylobothrium choprai* n.g. n.sp. may be provisionally accommodated in the proposed new genus.

The species is named after eminent Parasitologist, Prof. A.K. Chopra, Head Department of Zoology and Environment Science, Gurukul Kangri University, Haridwar (Uttranchal) India.

Host : *Channa punctatus* (Bloch)

Habitat : Intestine

Locality : Prithvipur, district Tikamgarh (M.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.) College, Jhansi (U.P.) India.

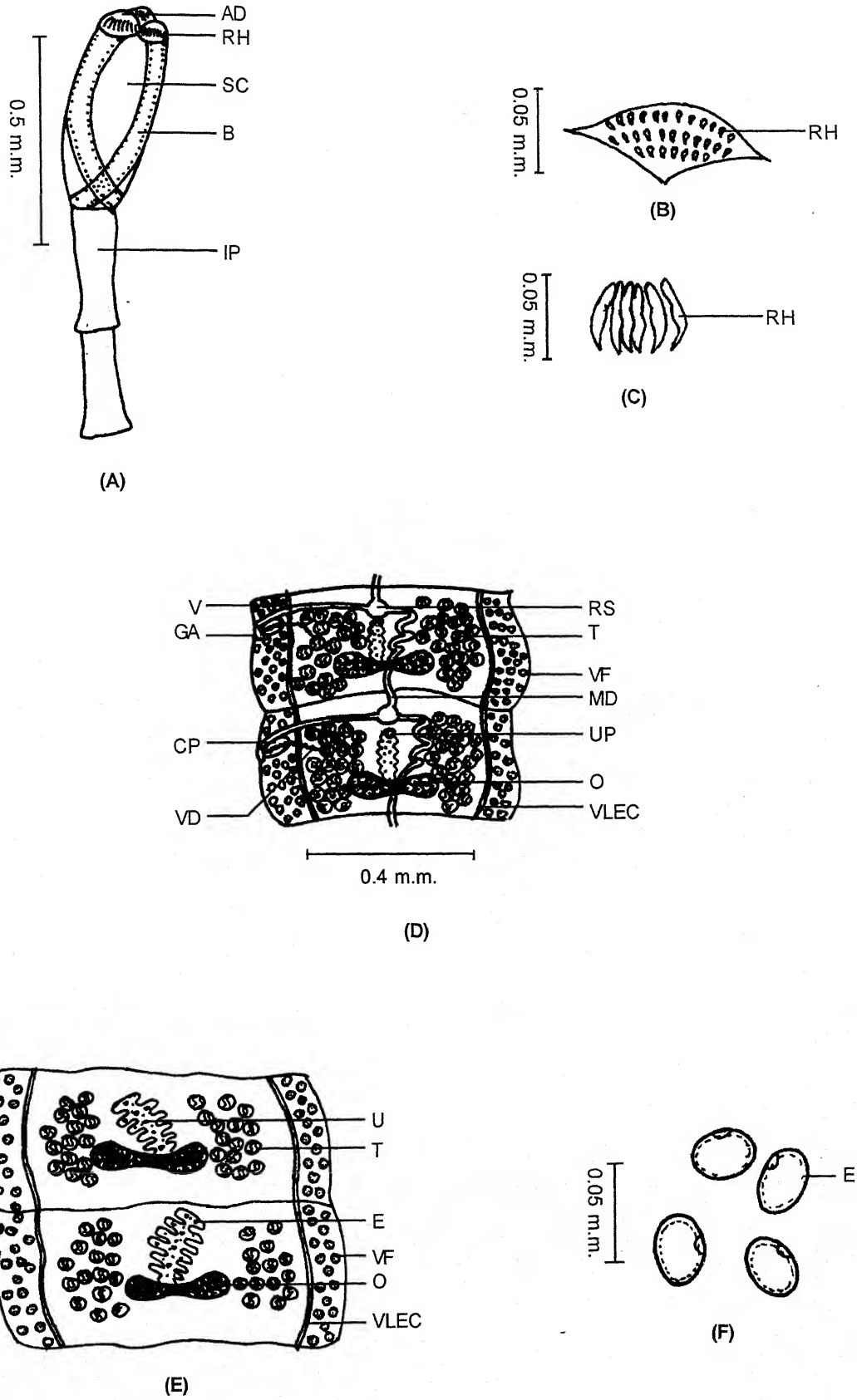

Fig. 16 : ***Dactylobothrium choprai*** n.g., n.sp., A - Scolex with immature proglottids (50X), B - Upper rows of rostellar hooks (225X), C - Lower row of rostellar hooks (225 X), D - Mature proglottids (50X), E - Gravid proglottids (50X) F - Eggs (225X)

TABLE 17: Comparison of the characters of the genus closer to *Dactylobothrium* n.g.

S.No.	Characters	*Glossobothrium* Yamaguti, 1952	*Dactylobothrium* n.g.
1	Apical disc	Unarmed	Armed
2	Bothrial appendages	Present	Absent
3	Ovary	Slightly poral	Medial
4	Genital atrium	Irregularly alternating	Unilateral
5	Mid duct	Absent	Present
6	Uterus	S-shaped	Coiled and irregular

(5.2)
Mastalobothrium agrawali n.g., n.sp.

Order : Pseudophyllidea Carus, 1863

Family : Parabothriocephalidae Yamaguti, 1959

Genus : *Mastalobothrium* n.g.

Species : *Mastalobothrium agrawali* n.g., n.sp.

***Mastalobothrium agrawali* n.g., n.sp.** (Fig.17)

Two hundred forty fishes, *Mastacembelus armatus* (Lacepede) caught from Betwa river, district Jhansi (U.P.) India, six were found infected with ten alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to a new genus, *Mastalobothrium* n.g. of the family Parabothriocephalidae Yamaguti, 1959; order Pseudophyllidea Carus, 1863.

GENERIC DIAGNOSIS

Large sized, segmented worms. Scolex elongated with two elongated bothria. Apical disc armed. Rostellar hooks present in single row.

Neck absent. Proglottids broader than long and acraspedote. Testes partly cortical partly medullary, arranged in two separate lateral fields. Cirrus pouch marginal. External and internal seminal vesicles absent. Ovary bilobed, medial and postequatorial. Vagina posterior to cirrus pouch. Receptaculum seminis and mehlis gland present. Vitellaria cortical, in two lateral bands. Genital atrium unilateral. Uterus coiled with posterior uterine pore. Eggs oval to round and operculate. Parasites of fresh water fishes.

***Mastalobothrium agrawali* n.g.n.sp.**

Worms large, segmented measure 120.0-180.0 X 1.25-1.75 (150.0 X 1.5). Scolex narrow anteriorly and broad posteriorly measures 0.687-0.937 X 0.35-0.465 (0.812 X 0.407). Apical disc armed measures 0.062-0.1 X 0.1-0.138 (0.81 X 0.119).

Rostellar hooks 32 in number, in a single row, arranged in two groups measure 0.060-0.078 (0.069) in length. Bothria elongated, shallow, two in number measure 0.687-0.85 X 0.1-0.15 (0.768 X 0.125). Neck absent.

Proglottids broader than long, acraspedote. Immature proglottids measure 0.125-0.187 X 0.312-0.5 (0.156 X 0.406). Mature proglottids 0.187-0.437 X 1.125-1.35 (0.312 X 1.23) and gravid proglottids 0.375-0.5 X 1.125-1.75 (0.437 X 1.437).

Testes partly cortical, partly medullary, 60-120 in number measure 0.015-0.038 X 0.018-0.046 (0.026 X 0.032), arranged in two lateral fields which crosses the ventral longitudinal excretory canals. Cirrus pouch marginal, oval, transversally oblique measures 0.05-0.075 X 0.037-0.05 (0.062 X 0.043). External and internal seminal vesicles absent. Vas deferens measures 0.006-0.011 (0.008) in diameter.

Ovary bilobed, medial, postequatorial measures 0.075-0.125 X 0.25-0.375 (0.1 X 0.312). Vagina measures 0.015-0.02 (0.017) in diameter, posterior to cirrus pouch. Receptaculum seminis measures 0.011-0.013 X 0.023-0.027 (0.012 X 0.025). Mehlis gland ovoid, postovarian measures 0.015-0.022 X 0.037-0.075 (0.018 X 0.056).

Vetelline follicles cortical measure 0.012-0.022 X 0.013-0.028 (0.017 X 0.020), in two lateral bands. Genital atrium unilateral measures 0.025-0.03 X 0.017-0.022 (0.027 X 0.019) in deep and wide respectively.

Uterus coiled, medial and measures 0.25-0.312 X 0.125-0.375 (0.281 X 0.25). Uterine pore posteriorly located measures 0.011-0.028 (0.019) in diameter.

Eggs oval to round, operculate and measure 0.024-0.033 X 0.027-0.038 (0.028 X 0.032). Ventral longitudinal excretory canals measure 0.018-0.022 (0.020) in diameter.

DISCUSSION

The present form comes closer to the genus *Glossobothrium* Yamaguti, 1952 of the family Parabothriocephalidae Yamaguti, 1959.

The present form differs from *Glossobothrium* Yamaguti, 1952 in having armed apical disc, absence of bothrial appendages, presence of medial ovary, unilateral genital atrium and differently shaped uterus (Table 18).

Thus the present form differs from all the known genera of the family Parabothriocephalidae Yamaguti, 1959.

In the light of above discussion the species, *Mastalobothrium agrawali* n.g., n. s.p. may be provisionally accommodated in the proposed new genus.

The species is named after eminent Parasitologist, Dr. Nirupama Agrawal, Head of Zoology Department, Lucknow University, Lucknow (U.P.), India.

Host : *Mastacembelus armatus* (Lacepede)

Habitat : Intestine

Locality : Betwa river, district Jhansi (U.P.) India

Holotype : Parasitological Laboratory, Department of Zoology , Bipin Bihari (P.G.) College, Jhansi (U.P.)

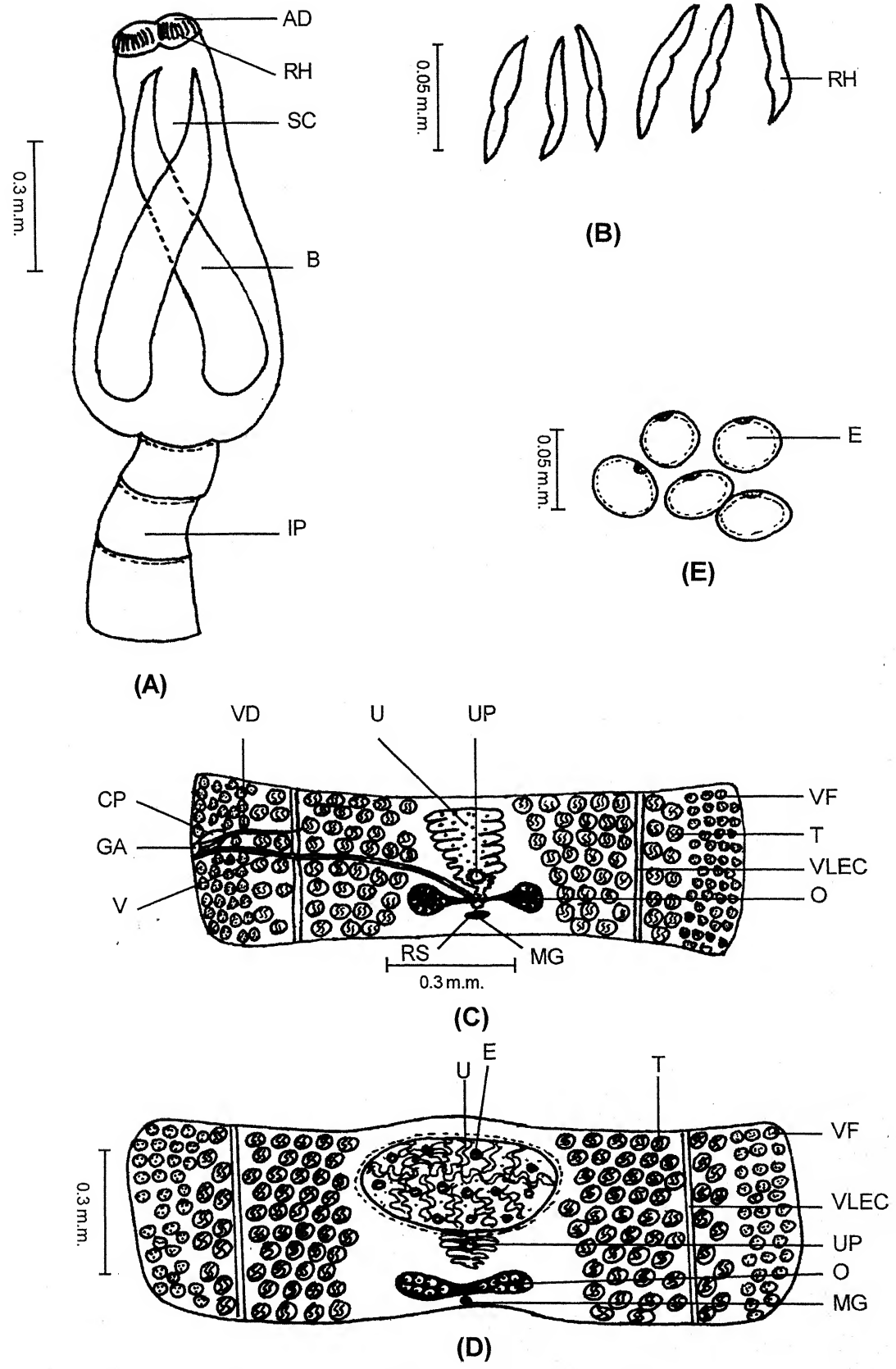

Fig. 17 : ***Mastalobothrium agrawali*** n.g., n.sp., A- Scolex with immature proglottids (50X), B- Rostellar hooks (225X), C- Mature proglottid (50X), D-Gravid proglottid (50X), E- Eggs (225X)

TABLE 18 : Comparison of the characters of the genus closer to *Mastalobothrium* n.g.

S. No.	Characters	*Glossobothrium* Yamaguti, 1952	*Mastalobothrium* n.g.
1	Apical disc	Unarmed	Armed
2	Bothrial appendages	Present	Absent
3	Ovary	Slightly poral	Medial
4	Genital atrium	Irregularly alternating	Unilateral
5	Uterus	S-shaped	Coiled and irregular

(5.3)
Neobothriocephalus sharmai n.sp.

Order : Pseudophyllidea Carus, 1863

Family : Parabothriocephalidae Yamaguti, 1959

Genus : *Neobothriocephalus* Mateo *et* Bullock, 1966

Species : *Neobothriocephalus sharmai* n.sp.

***Neobothriocephalus sharmai* n.sp.** (Fig. 18)

Six fishes, *Channa punctatus* (Bloch) caught from Baruasagar, district Jhansi (U.P.) India, two were found infected with three alike cestodes in their intestines. Morphological studies of the cestodes revealed them to belong to the genus, *Neobothriocephalus* Mateo *et* Bullock, 1966 of the family Parabothriocephalidae Yamaguti, 1959; order Pseudophyllidea Carus, 1863.

Cestodes medium sized, segmented measure 26.0-36.0 X 0.615-1.031 (31.0 X 0.823). Scolex cylindrical with two elongated bothria and measurs 0.356-0.430 X 0.106-0.176 (0.393 X 0.141). Scolex bears cap shaped armed apical disc measures 0.061-0.068 X 0.096 - 0.150 (0.064 X 0.123). Rostellar hooks 24-28 in number measure 0.034-0.059 (0.046) in length, handle of rostellar hook comparatively small, guard medium and blade long. Bothria shallow measure 0.310-0.430 X 0.037-0.062 (0.370 X 0.049). Neck absent.

Proglottids craspedote. Immature proglottids longer than broad while mature and gravid proglottids broader than long. Immature proglottids measure 0.202-0.319 X 0.052-0.063 (0.260 X 0.057). Mature proglottids 0.191-0.369 X 0.504-1.031 (0.280 X 0.767) and gravid proglottids 0.252-0.350 X 0.403-0.815 (0.301 X 0.609).

Testes partly cortical and partly medullary, 40-80 in number measure 0.018-0.036 X 0.021 - 0.037 (0.027 X 0.029), crosses the ventral longitudinal excretory canals. Some testes postovarian. Cirrus pouch oval, submarginal, transversely oblique and measures 0.051-0.093 X 0.032-0.040 (0.072 X 0.036). External seminal vesicle measures 0.013-0.025 X 0.033-

0.058 (0.019 X 0.045). Internal seminal vesicle absent. Vas deferens measures 0.008-0.013 (0.010) in diameter.

Ovary fan shaped, medial, postequatorial measures 0.056-0.089 X 0.202-0.328 (0.072 X 0.265). Vagina measures 0.011-0.013 (0.012) in diameter, posterior to cirrus pouch. Receptaculum seminis measures 0.012-0.023 X 0.024-0.037 (0.017 X 0.030).

Vitelline follicles cortical measure 0.012-0.023 X 0.012-0.023 (0.017 X 0.017), in two lateral bands. Genital atrium irregularly alternating measures 0.023-0.028 X 0.010-0.012 (0.025 X 0.011) in deep and wide respectively.

Uterus coiled, tubular measures 0.127-0.315 X 0.065-0.251 (0.221 X 0.158). Uterine pore ventral, medial measures 0.037-0.065 (0.051) in diameter, situated on the anterior end of the uterus.

Eggs operculate measure 0.021-0.027 X 0.024-0.035 (0.024 X 0.029), with conspicuous lateral swelling. Ventral longitudinal excretory canals measure 0.012-0.013 (0.012) in diameter.

DISCUSSION

The present form comes closer to *Neobothriocephalus aspinosus* Mateo *et* Bullock, 1966 of the family Parabothriocephalidae Yamaguti, 1959.

The present form differs from *Neobothriocephalus aspinosus* Mateo *et* Bullock, 1966 in having cylindrical scolex, clearly craspedote proglottids, greater number of testes arranged in cortical and medullary region, fan-shaped medial ovary and absence of medullary vitelline follicles (Table 19).

In the light of above discussion the present form may be provisionally accommodated in the proposed new species.

The name of the species is after eminent Parasitologist Prof. Subhasini Sharma, Department of Zoology, University of Rajasthan, Jaipur (Raj.) India.

Host : *Channa punctatus* (Bloch)

Habitat : Intestine

Locality : Baruasagar, district Jhansi (U.P.) India

Holotype : Parasitological laboratory, Department of Zoology, Bipin Bihari (P.G.), College, Jhansi (U.P.) India.

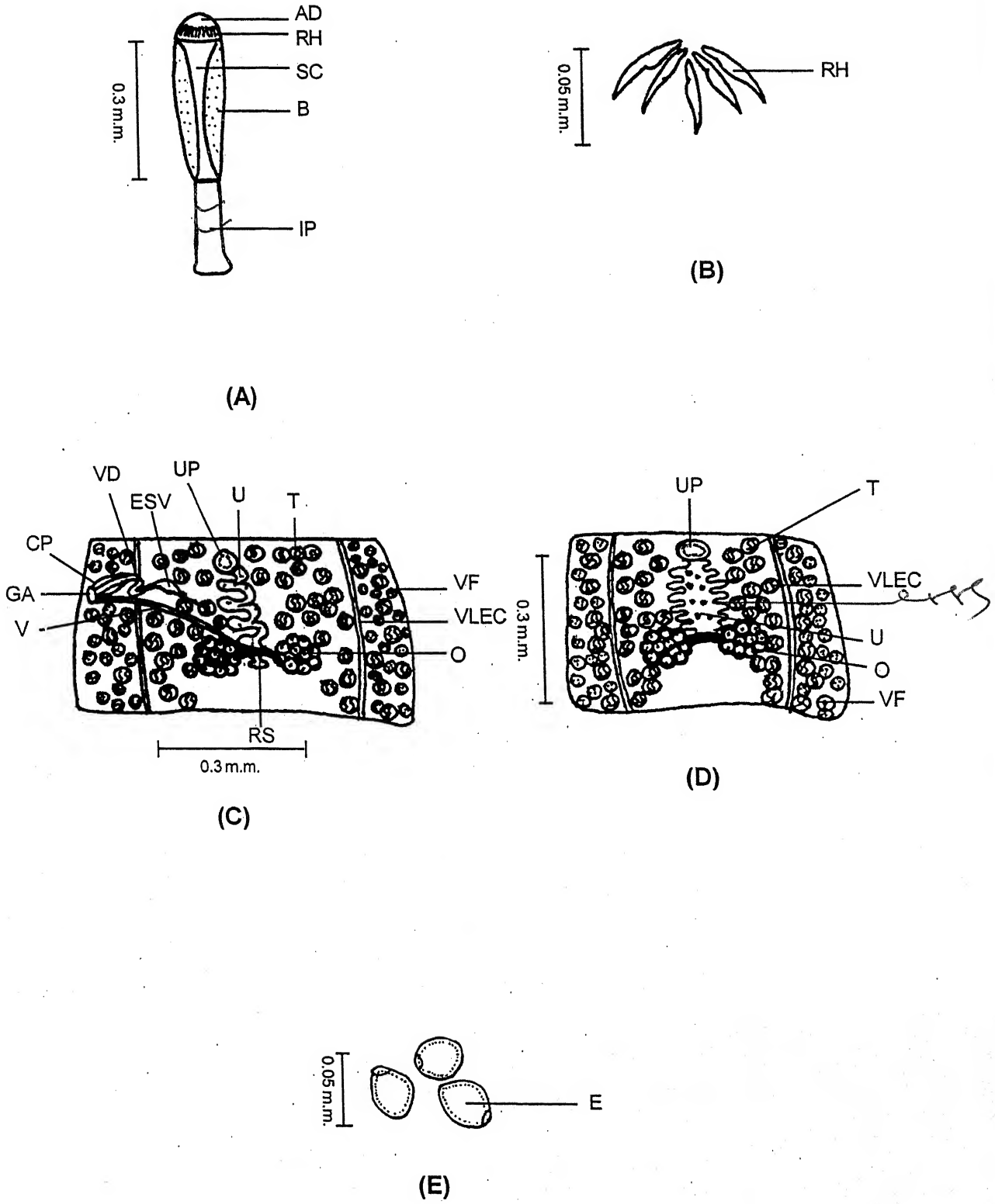

Fig. 18 : ***Neobothriocephalus sharamai*** n.sp., A- Scolex with immature proglottid (50X), B- Rostellar hooks (225X), C- Mature proglottid (50X), D-Gravid proglottid (50X), E- Eggs (225X)

TABLE 19 : Comparison of the characters of the species closer to *Neobothriocephalus sharmai* n. sp.

S. No.	Characters	*Neobothriocephalus aspinosus* Mateo *et* Bullock, 1966	*Neobothriocephalus Sharmai* n.sp.
1	Scolex	Ovoid	Cylindrical
2	Neck	Absent	Absent
3	Proglottids	Slightly craspedote	Clearly craspedote
4	Tester	Medullary, 25-60 in number	Partly cortical partly medullary, 40-80 in number
5	Ovary	Bilobed and slightly poral	Fan shaped and medial
6	Vitelline follicles	Partly cortical partly medullary	Cortical
7	Genital atrium	Submarginal, irregularly alternating	Submarginal, irregularly alternating
8	Eggs	Operculate with lateral swelling	Operculate with lateral swelling

Table 20 : Differences between new genera of the family Parabothriocephalidae Yamaguti, 1959

S.No.	Characters	*Dactylobothrium* n.g.	*Mastalobothrium* n.g.
1	Size of worms	Medium	Large
2	Rows of rostellar hooks	Four	Single
3	Position of testes	Medullary	Partly cortical partly medullary
4	Position of vagina	Anterior to cirrus pouch	Posterior to cirrus pouch
5	Receptaculum seminis	Preovarian	Postovarian
6	Mid duct	Present	Absent
7	Mehlis gland	Absent	Present
8	Uterine pore	Anterior	Posterior

Revised key to the various genera of the family Parabothriocephalidae Yamaguti, 1959

1. Genital pores marginal.....2

   Genital pores dorsal, near lateral margin 5

2. Apical disc absent. Bothria lacking appendages.....

   .....*Probothriocephalus* Campbell, 1979

   Apical disc present.....3

3. Apical disc unarmed. Bothria with prominant, posterior appendages.....*Glossobothrium* Yamaguti, 1952

   Apical disc armed and bothrial appendages absent.....4

4. Rostellar hooks in four rows..... *Dactylobothrium* n.g.

   Rostellar hooks in single row..... *Mastalobothrium* n.g.

5. Cirrus unarmed. Eggs with conspicuous lateral swelling.....

   .....*Neobothriocephalus* Mateo. *et* Bullock, 1966

   Cirrus spined. Eggs lacking lateral swelling.....6

6. Testes in two lateral fields..... *Metabothriocephalus* Yamaguti, 1968

   Testes in single median field.....7

7. Vitellaria cortical. Scolex lacking, replaced with pseudoscolex with shallow depression.....*Parabothriocephaloides* Yamaguti, 1934

   Vitellaria medullary. Scolex present, small.....

   .....*Parabothriocephalus* Yamaguti, 1934

Part-C

ECOLOGICAL OBSERVATION

To study the nature of cestode infection in fresh water fish, *Mastacembelus armatus* (Lacepede) from Betwa river, district Jhansi (U.P.) India, two hundred and forty fishes were examined for two successive years from July 2003 to June 2005. In each month ten fishes were sacrificed.

Out of 240 hosts examined, only 31 were found infected with 49 cestodes. Thus the average annual prevalence of cestode infection in *Matacembelus armatus* (Lacepede) was (0.129), Mean intensity (1.580) and relative density (0.204).

Only 574 nematodes were obtained from 81 fishes. Thus the prevalence of nematode infection was (0.337), mean intensity (7.086) and the relative density (2.391).

Only 2 trematodes were found from 2 fishes. Thus the prevalence of trematode infection was (0.008), mean intensity (1.0) and relative density (0.008).

Only 17 acanthocephala were obtained from 13 fishes. Thus the prevalence of acanthocephala infection was (0.054), mean intensity (1.307) and relative density (0.07) (Table 21 Fig. 19).

TABLE 21 : Average annual variations in the prevalence, mean intensity and relative density of helminths infection in *Mastacembelus armatus* (Lacepede)

Number of hosts examined	240
Number of hosts infected with	
Cestodes	31
Nematodes	81
Trematodes	2
Acanthocephala	13
Prevalence of	
Cestodes	0.129
Nematodes	0.337
Trematodes	0.008
Acanthocephala	0.054
Number of worm obtained	
Cestodes	49
Nematodes	574
Trematodes	2
Acanthocephala	17
Mean intensity	
Cestodes	1.580
Nematodes	7.086
Trematodes	1.0
Acanthocephala	1.307
Relative density	
Cestodes	0.204
Nematodes	2.391
Trematodes	0.008
Acanthocephala	0.07

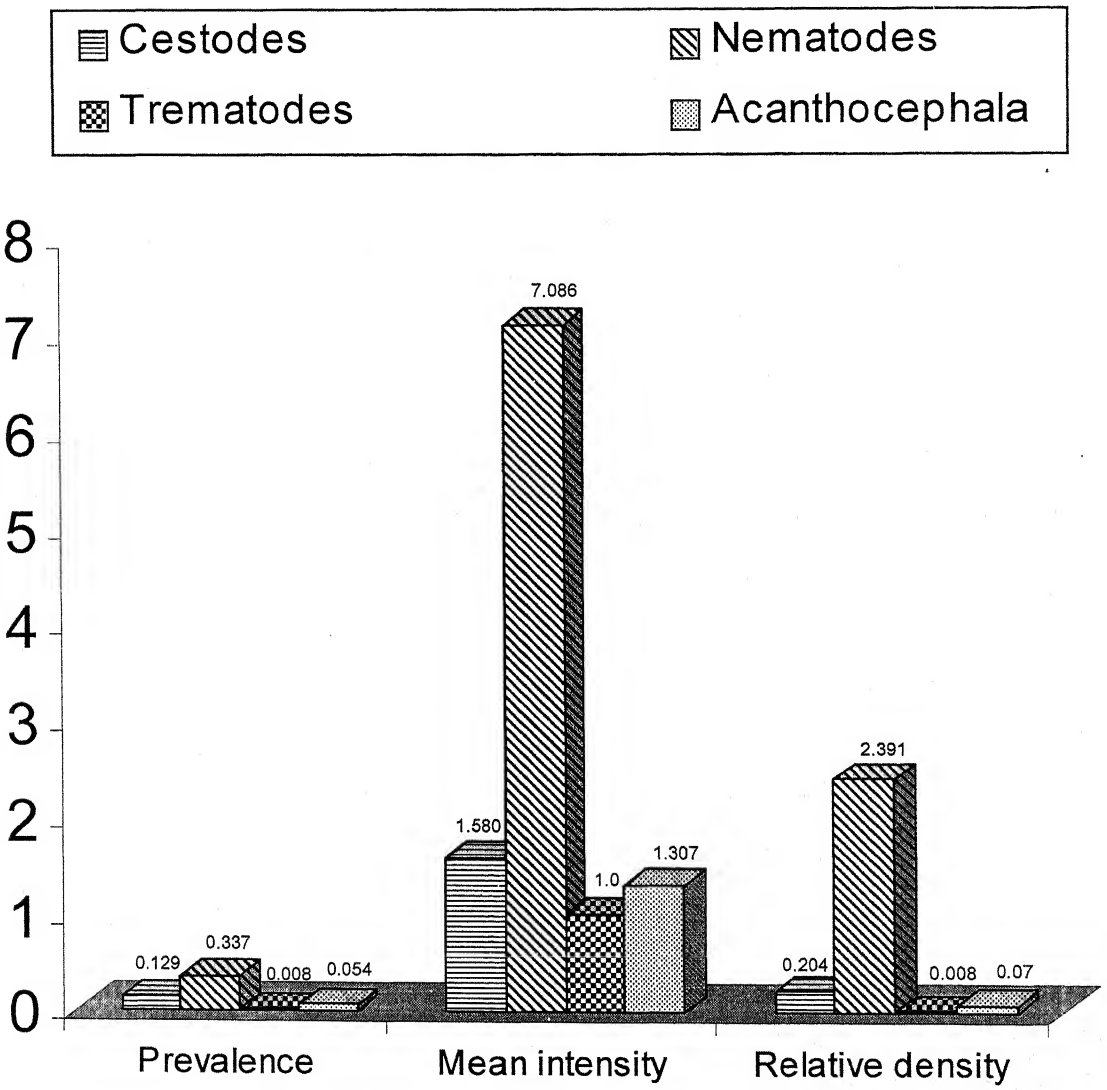

Fig. 19 : Average annual variations in the prevalence, mean intensity and relative density of helminths infection in *Mastacembelus armatus* (Lacepede)

Average seasonal variations in the prevalance, mean intensity and relative density of cestode infection in *Mastacembelus armatus* (Lacepede) were as follows :-

The prevalance of cestode infection was highest (0.212) during summer season and lowest (0.05) in rainy season (Table 22, Fig. 20).

The mean intensity of cestode infection was highest (1.9) during winter season and lowest (1.0) during rainy season (Table22 Fig. 20).

The relative density of cestode infection was highest (0.325) during summer season and lowest (0.05) in rainy season (Table 22 Fig 20).

TABLE 22 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in *Mastacembelus armatus* (Lacepede)

Season	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Rainy	80	04	0.05	04	1.0	0.05
Winter	80	10	0.125	19	1.9	0.237
Summer	80	17	0.212	26	1.529	0.325

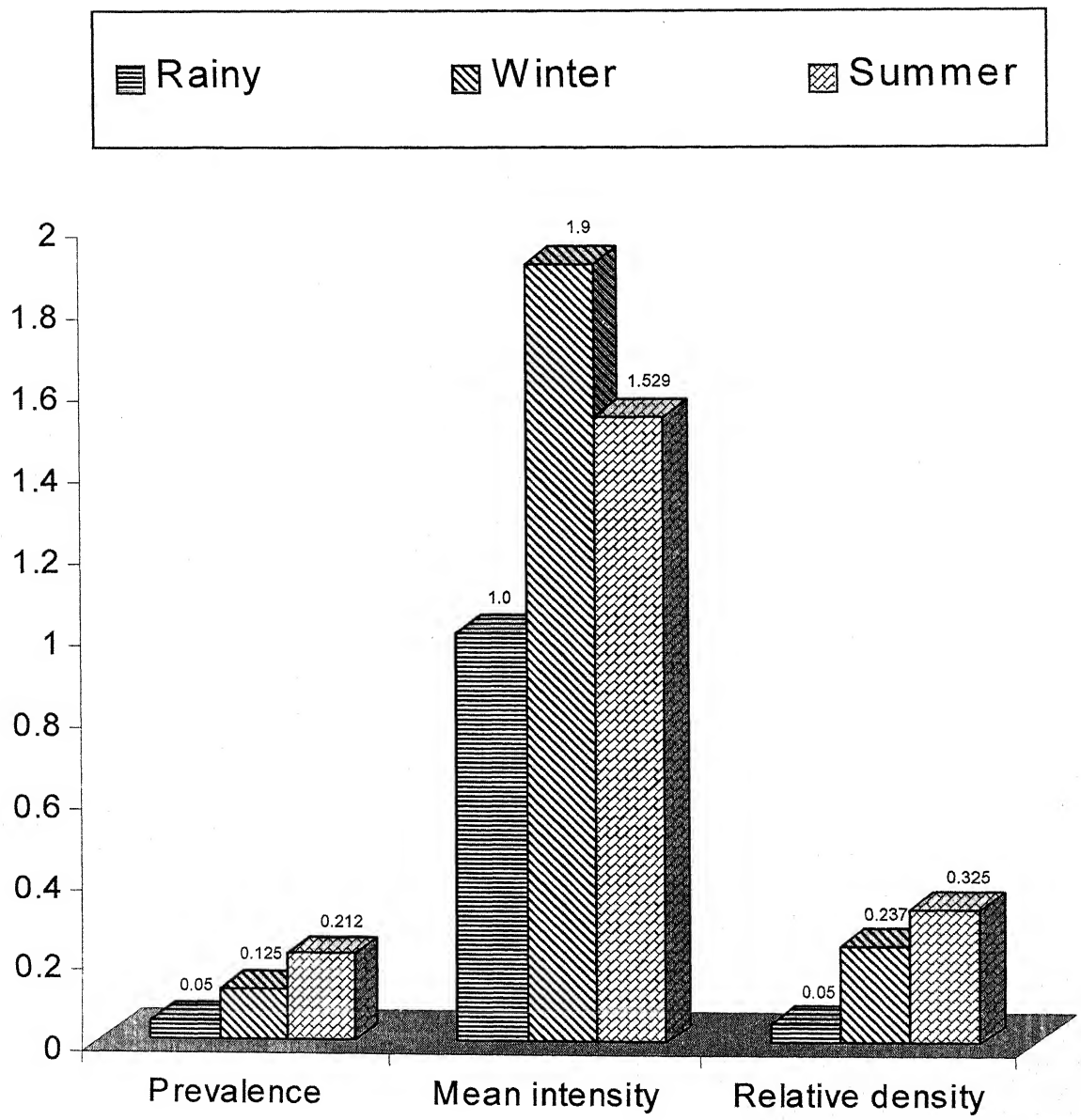

Fig. 20 : Average seasonal variations in the prevalence, mean intensity and relative density of helminths infection in *Mastacembelus armatus* (Lacepede)

Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in *Mastacembelus armatus* (Lacepede) have been depicted in (Table 23 Fig. 21).

The maximum prevalence (0.35) was recorded in the month of April whereas minimum (O) in August, September, December and January. In rest of the months it ranges in between 0.1 to 0.25 (Table 23, Fig. 21).

The maximum mean intensity (2.4) was recorded in November whereas minimum (O) in August, September, December and January. In rest of the months it ranges from 1.0 to 1.857. (Table 23, Fig. 21).

The relative density (0.65) was maximum in the month of April whereas minimum (O) in August, September, December and January. In rest of the months it ranges from 0.1 to 0.6 (Table 23, Fig. 21).

TABLE 23 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in *Mastacembelus armatus* (Lacepede)

Month/ Years	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
July (03-04)	20	2	0.1	2	1.0	0.1
Aug. (03-04)	20	0	0	0	0	0
Sept. (03-04)	20	0	0	0	0	0
Oct. (03-04)	20	2	0.1	2	1.0	0.1
Nov. (03-04)	20	5	0.25	12	2.4	0.6
Dec. (03-04)	20	0	0	0	0	0
Jan. (04-05)	20	0	0	0	0	0
Feb. (04-05)	20	5	0.25	7	1.4	0.35
March (04-05)	20	4	0.2	5	1.25	0.25
April (04-05)	20	7	0.35	13	1.857	0.65
May (04-05)	20	4	0.2	5	1.25	0.25
June (04-05)	20	2	0.1	3	1.5	0.15

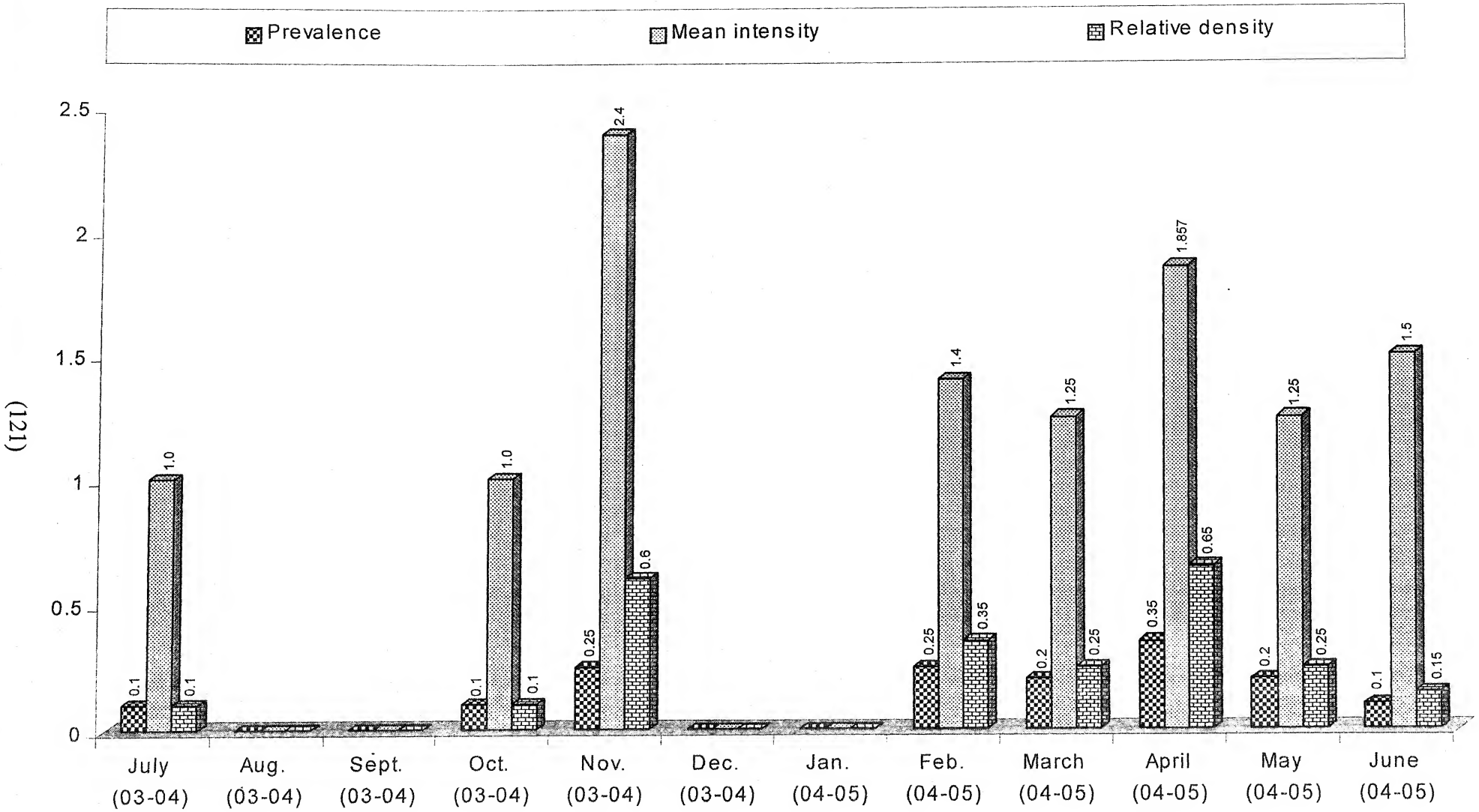

Fig. 21 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in *Mastacembelus armatus* (Lacepede)

I- CESTODE INFECTION IN RELATION TO THE BODY WEIGHT OF THE HOST :-

(a) Average annual variations [Table 24 Fig. 22] :-

(i) Prevalence

The maximum prevalence of cestode infection (0.260) was recorded in the host ranging from 151-250 gm. body weight while minimum (0.915) was recorded in the host ranging from 51-150 gm. body weight.

(ii) Mean intensity

The maximum mean intensity of cestode infection (1.75) was recorded in the host ranging from 151-250 gm. body weight while minimum (1.428) was recorded in the host ranging 51-150 gm. body weight.

(iii) Relative density

The maximum relative density (0.456) of cestode infection was recorded in the host ranging from 151-250 gm. body weight while minimum (0.130) was recorded in the host ranging from 51-150 gm. body weight.

TABLE 24 : Average annual variations in the prevalence, mean intensity and relative density of cestode infection in relation to body weight of the host

Range of the body weight (gm.)	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
51-150	153	14	0.0915	20	1.428	0.130
151-250	46	12	0.260	21	1.75	0.456
251-350	20	3	0.15	5	1.666	0.25
351-450	21	2	0.095	3	1.5	0.142

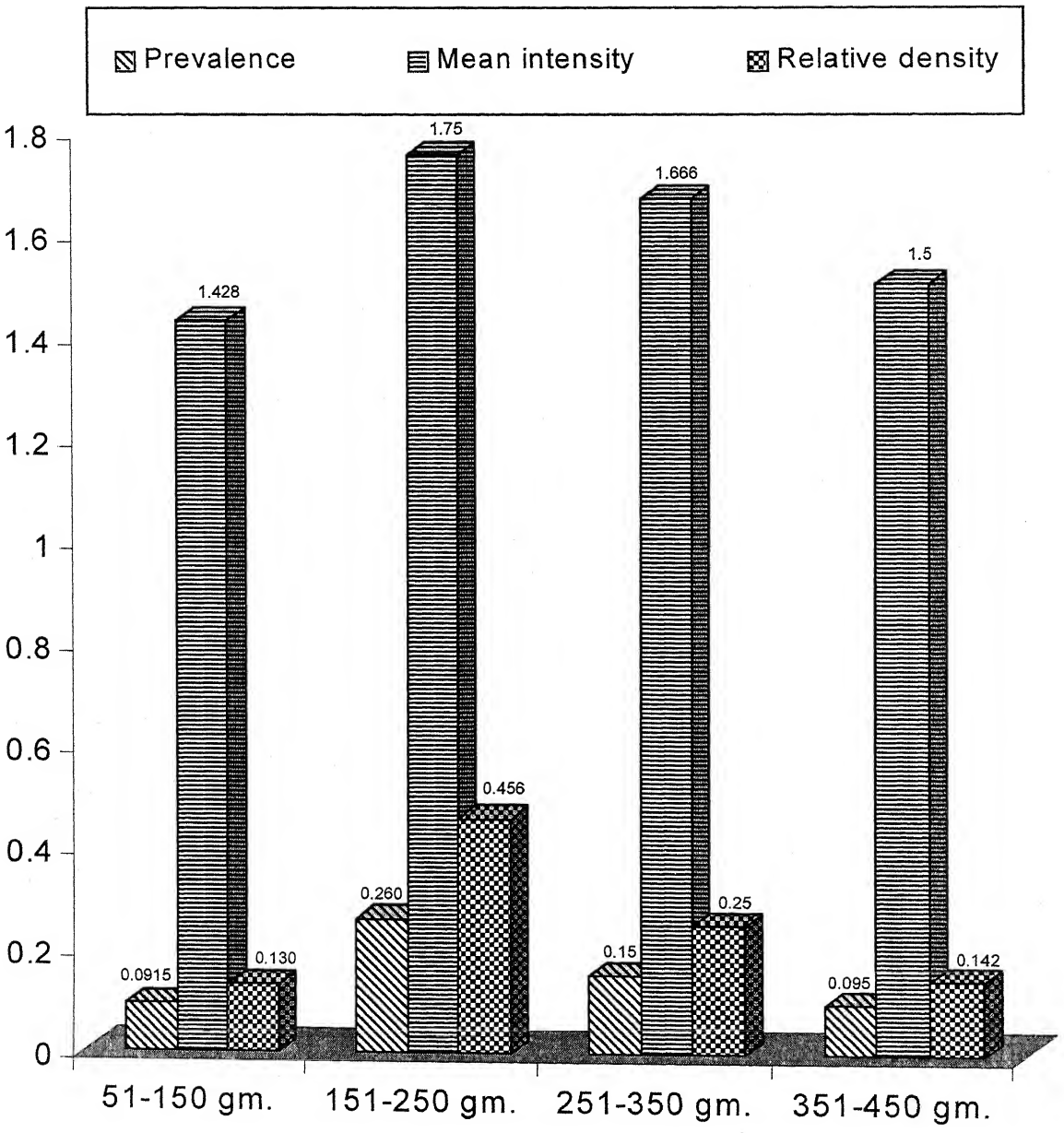

Fig. 22 : Average annual variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host

(b) Average seasonal variations (Tables 25-28, Figs. 23-26):-

(i) Prevalence

The maximum prevalence (0.466) was recorded in the host body weight ranging from 151-250 gm. during summer season.

The minimum prevalence (O) was recorded in host body weight ranging from 351-450 gm. during rainy and winter seasons.

(ii) Mean intensity

The maximum mean intensity of cestode infection (3.0) was recorded in the host body weight ranging from 151-250 gm during winter season and 251-350 gm during summer season.

The minimum mean intensity of cestode infection (O) was recorded in the host body weight ranging from 351-450 gm during rainy and winter seasons.

(iii) Relative density

The maximum relative density of cestode infection (0.666) was recorded in the host body weight ranging from 151-250 gm during summer season.

The minimum relative density of cestode infection (O) was recorded in the host body weight ranging from 351-450 gm during rainy and winter seasons.

TABLE 25 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (51-150 gm.)

Season	No. of hosts		Prevalence	Number of cestodes obtained	Mean itensity	Relative density
	Examined	Infected				
Rainy	54	1	0.018	1	1.0	0.018
Winter	49	6	0.122	9	1.5	0.183
Summer	50	7	0.14	10	1.428	0.2

TABLE 26: Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (151-250 gm.)

Season	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Rainy	11	2	0.181	2	1.0	0.181
Winter	20	3	0.15	9	3.0	0.45
Summer	15	7	0.466	10	1.428	0.666

TABLE 27 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (251-350 gm.)

Season	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Rainy	6	1	0.166	1	1.0	0.166
Winter	6	1	0.166	1	1.0	0.166
Summer	8	1	0.125	3	3.0	0.375

TABLE 28 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (351-450 gm.)

Season	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Rainy	9	0	0	0	0	0
Winter	5	0	0	0	0	0
Summer	7	2	0.285	3	1.5	0.428

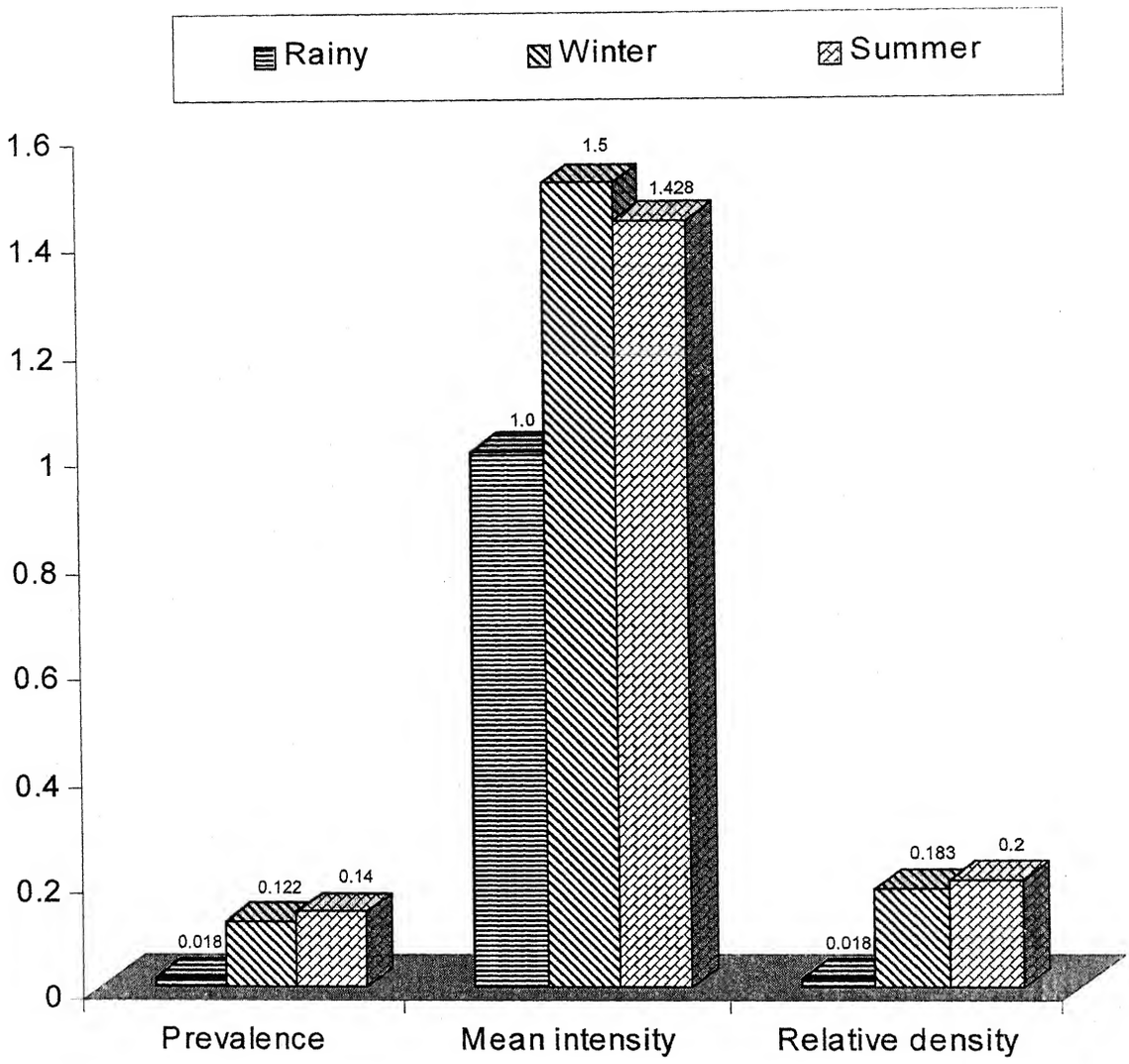

Fig. 23 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (51-150 gm.)

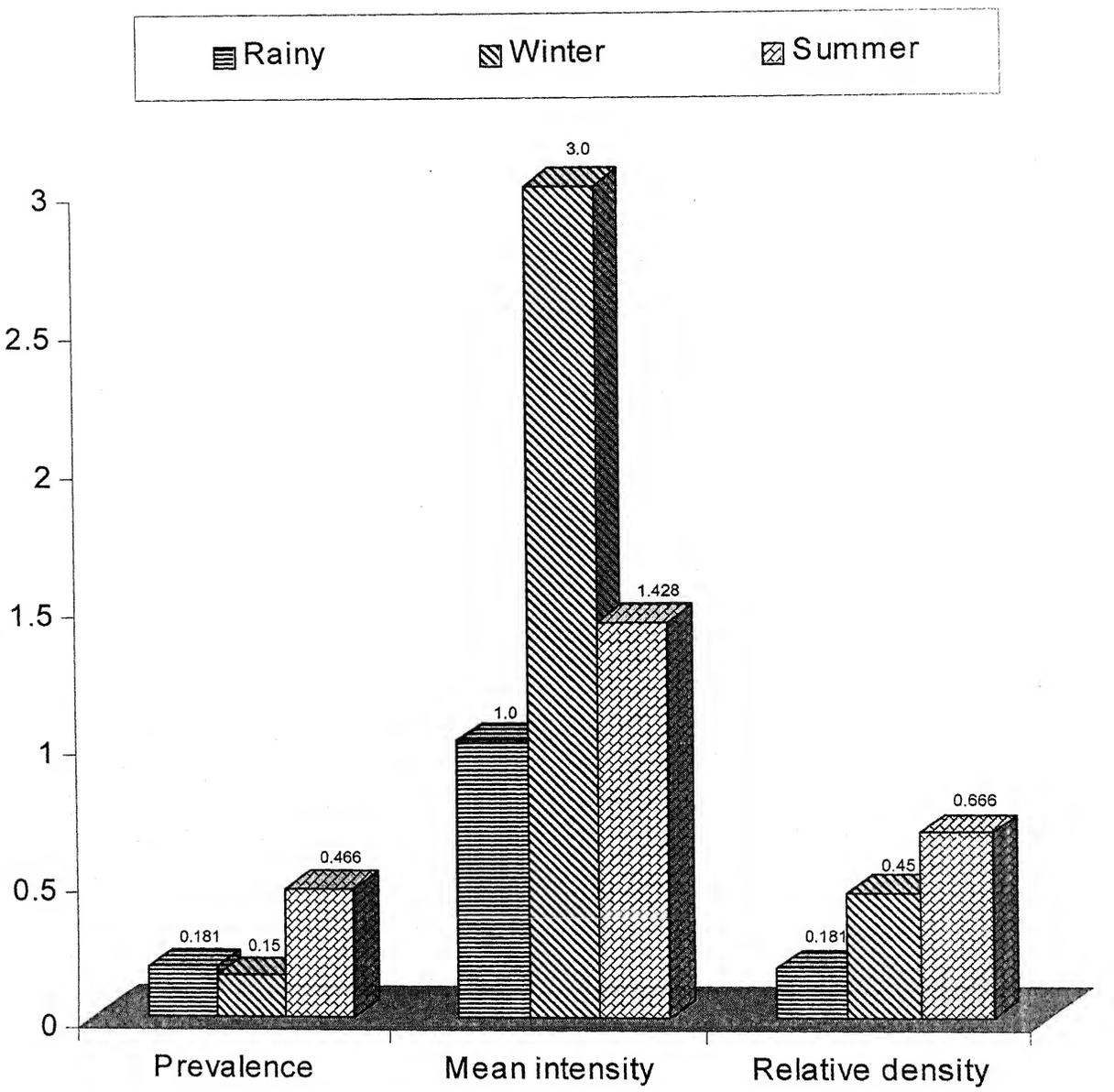

Fig. 24 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (151-250 gm.)

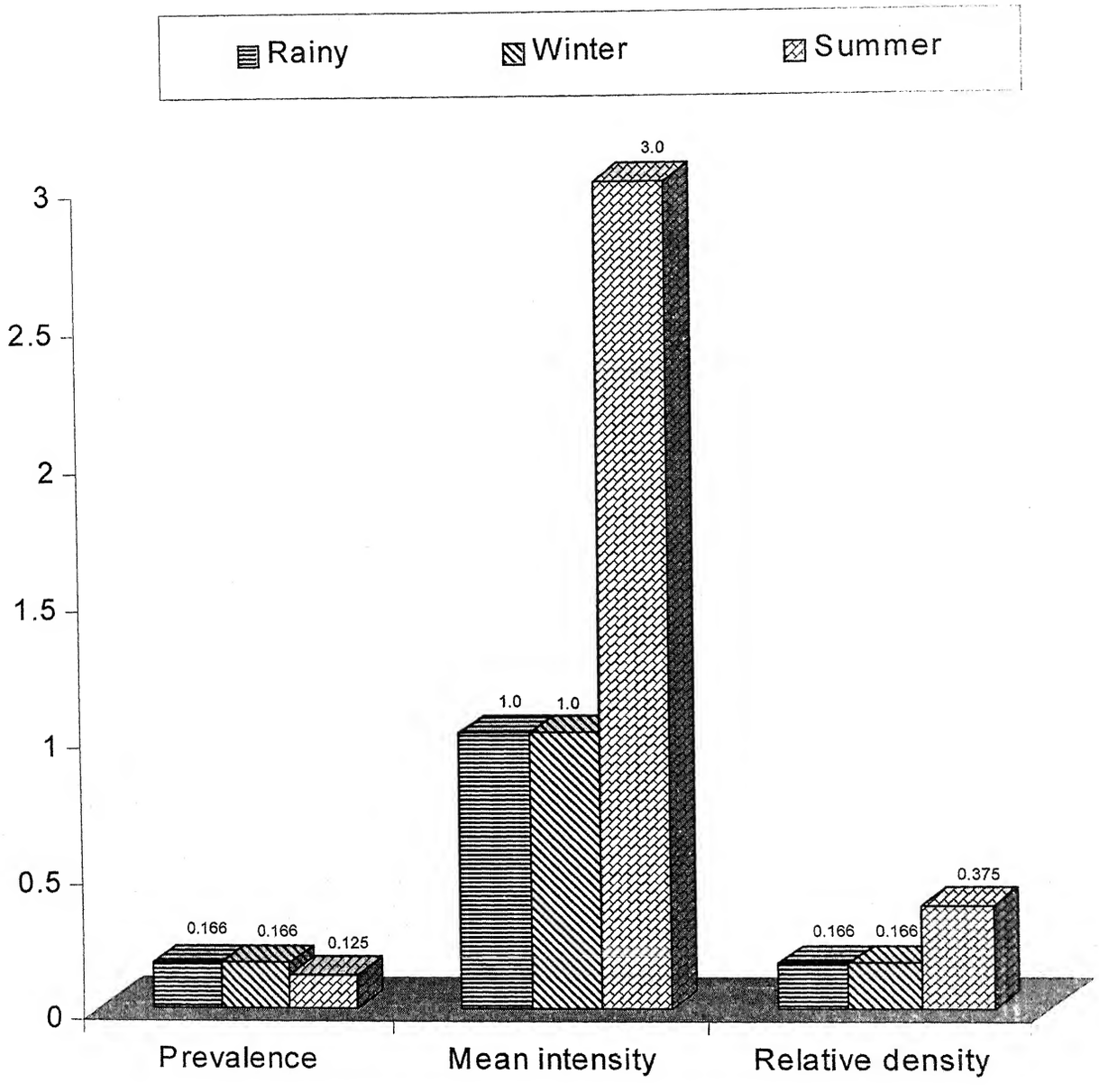

Fig. 25 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (251-350 gm.)

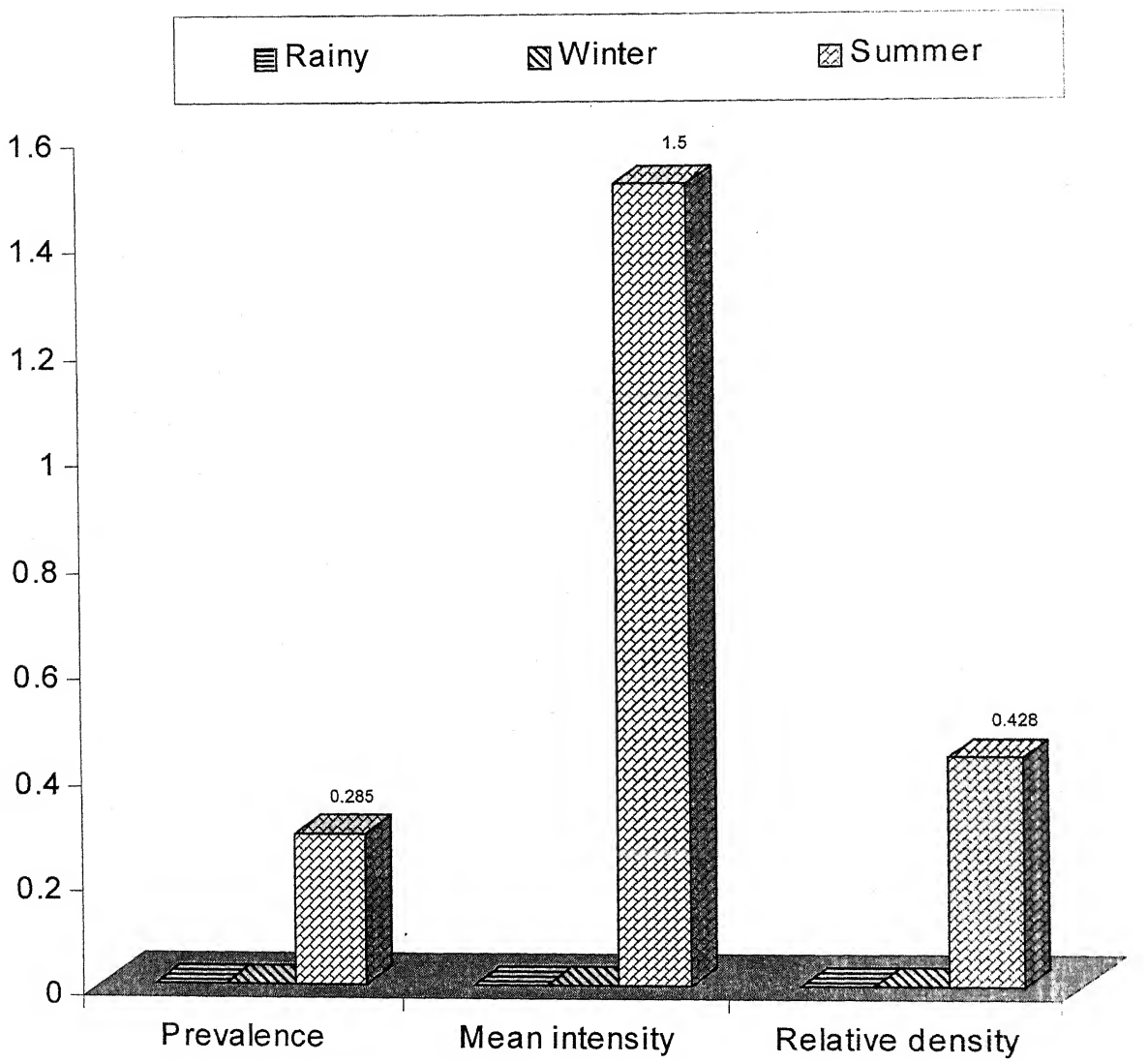

Fig. 26 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (351-450 gm.)

(C) Average monthwise variations [Tables 29-32 Figs. 27-30]

(i) Prevalence

In the host body weight ranging from 51-150 gm. the maximum prevalence (0.25) was recorded in November whereas minimum (O) in August, September, October, December and January. In rest of the months it ranges from 0.071 to 0.214.

In the host body weight ranging from 151-250 gm. the maximum prevalence (1.0) was recorded in the month of March whereas minimum (O) in August, September, December and January. In rest of the months it ranges from 0.25 to 0.5.

In the host body weight ranging from 251-350 gm. the maximum prevalence (1.0) was recorded in the months of February and April while minimum (O) in July, August, September, November, December, January, March, May and June. In rest of single month it was 0.5.

In the host body weight ranging from 351-450 gm. the maximum prevalence (1.0) was recorded in the month of April whereas minimum (O) was recorded in all other months.

(ii) Mean intensity

In the host body weight ranging from 51-150 gm. the maximum mean intensity (1.666) was recorded in the months of February and April whereas minimum (O) in August, September October, December and January. In rest of the months it ranges from 1.0 to 1.5.

In the host body weight ranging from 151-250 gm. the maximum mean intensity (4.0) was recorded in the month of November while minimum (O) in August, September, December and January. In rest of the months it ranges from 1.0 to 2.0.

In the host body weight ranging from 251 to 350 gm. the maximum mean intensity (3.0) was recorded in April whereas minimum (O) in July, August, September, November, December, January, March, May and June. In rest of two months it were 1.0.

In the host body weight ranging from 351-450 gm. the maximum mean intensity (1.5) was recorded in the month of April while minimum (O) was recorded in all other months.

(iii) Relative density

In the host body weight ranging from 51-150 gm. the maximum relative density (0.357) was recorded in the month of April while minimum (O) in August, September, October, December and January. In rest of the months it ranges from 0.071 to 0.333.

In the host body weight ranging from 151-250 gm. the maximum relative density (1.333) was recorded in November and March whereas minimum (O) in August, September, December and January. In rest of the months it ranges from 0.25 to 0.666.

In the host body weight ranging from 251-350 gm. the maximum relative density (3.0) was recorded in the month of April while minimum (O) in July, August, September, November, December, January, March, May and June. In rest of two months it ranges from 0.5 to 1.0.

In the host body weight ranging from 351-450 gm. the maximum relative density (1.5) was recorded in April while minimum (O) in all other months.

TABLE 29 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (51-150 gm.)

Month/ Years	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
July (03-04)	12	1	0.083	1	1.0	0.083
Aug. (03-04)	14	0	0	0	0	0
Sept. (03-04)	17	0	0	0	0	0
Oct. (03-04)	11	0	0	0	0	0
Nov. (03-04)	12	3	0.25	4	1.333	0.333
Dec. (03-04)	10	0	0	0	0	0
Jan. (04-05)	11	0	0	0	0	0
Feb. (04-05)	16	3	0.187	5	1.666	0.312
March (04-05)	14	1	0.071	1	1.0	0.071
April (04-05)	14	3	0.214	5	1.666	0.357
May (04-05)	12	2	0.166	3	1.5	0.25
June (04-05)	10	1	0.1	1	1.0	0.1

TABLE 30 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (151-250 gm.)

Month/ Years	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
July (03-04)	3	1	0.333	1	1.0	0.333
Aug. (03-04)	3	0	0	0	0	0
Sept. (03-04)	1	0	0	0	0	0
Oct. (03-04)	4	1	0.25	1	1.0	0.25
Nov. (03-04)	6	2	0.333	8	4.0	1.333
Dec. (03-04)	6	0	0	0	0	0
Jan. (04-05)	6	0	0	0	0	0
Feb. (04-05)	2	1	0.5	1	1.0	0.5
March (04-05)	3	3	1.0	4	1.333	1.333
April (04-05)	3	1	0.333	2	2.0	0.666
May (04-05)	6	2	0.333	2	1.0	0.333
June (04-05)	3	1	0.333	2	2.0	0.666

TABLE 31 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (251-350 gm.)

Month/ Years	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
July (03-04)	2	0	0	0	0	0
Aug. (03-04)	1	0	0	0	0	0
Sept. (03-04)	1	0	0	0	0	0
Oct. (03-04)	2	1	0.5	1	1.0	0.5
Nov. (03-04)	1	0	0	0	0	0
Dec. (03-04)	2	0	0	0	0	0
Jan. (04-05)	2	0	0	0	0	0
Feb. (04-05)	1	1	1.0	1	1.0	1.0
March (04-05)	1	0	0	0	0	0
April (04-05)	1	1	1.0	3	3.0	3.0
May (04-05)	1	0	0	0	0	0
June (04-05)	5	0	0	0	0	0

TABLE 32 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (351-450 gm.)

Month/ Years	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
July (03-04)	3	0	0	0	0	0
Aug. (03-04)	2	0	0	0	0	0
Sept. (03-04)	1	0	0	0	0	0
Oct. (03-04)	3	0	0	0	0	0
Nov. (03-04)	1	0	0	0	0	0
Dec. (03-04)	2	0	0	0	0	0
Jan. (04-05)	1	0	0	0	0	0
Feb. (04-05)	1	0	0	0	0	0
March (04-05)	2	0	0	0	0	0
April (04-05)	2	2	1.0	3	1.5	1.5
May (04-05)	1	0	0	0	0	0
June (04-05)	2	0	0	0	0	0

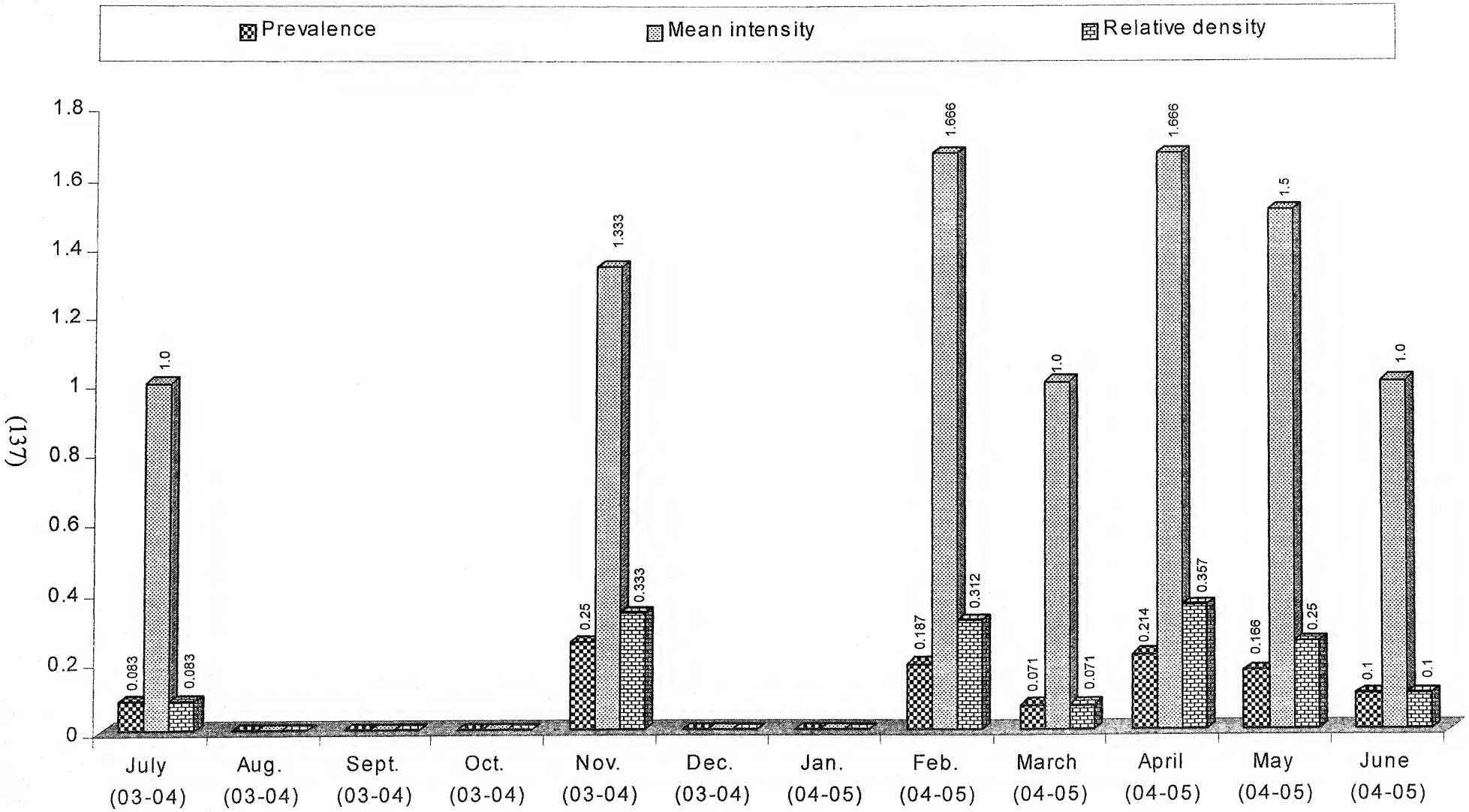

Fig. 27 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (51-150 gm.)

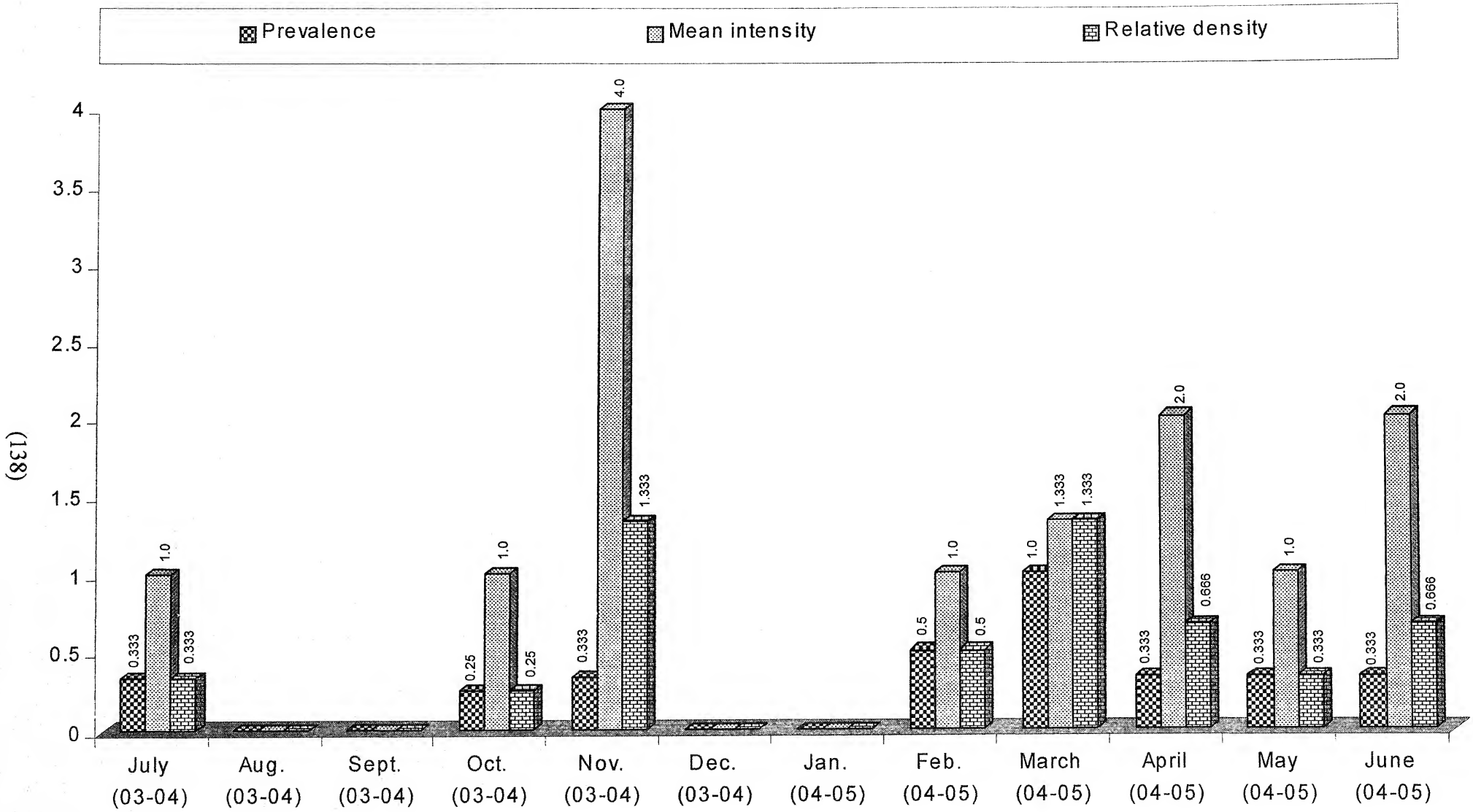

Fig. 28 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (151-250 gm.)

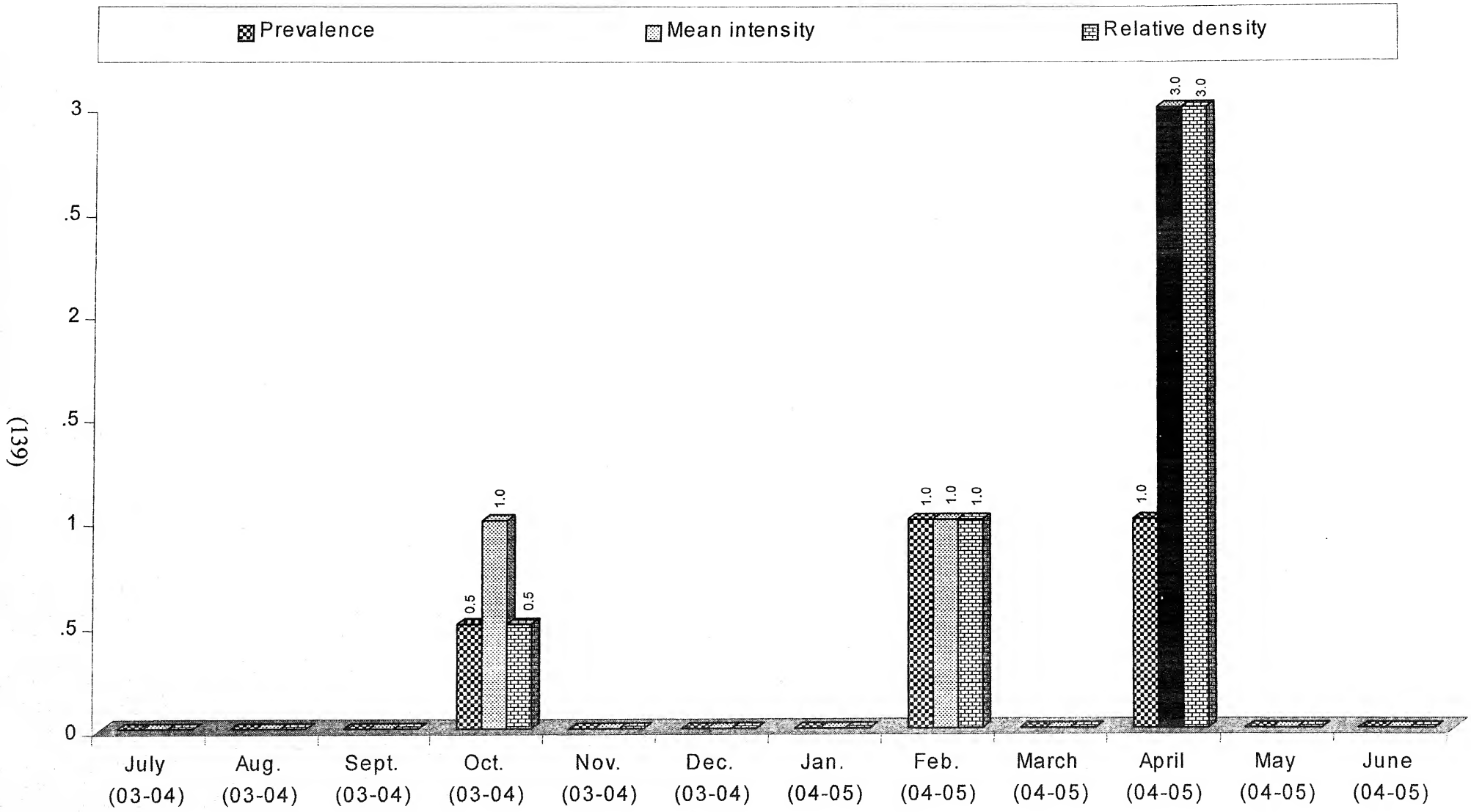

Fig. 29 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (251-350 gm.)

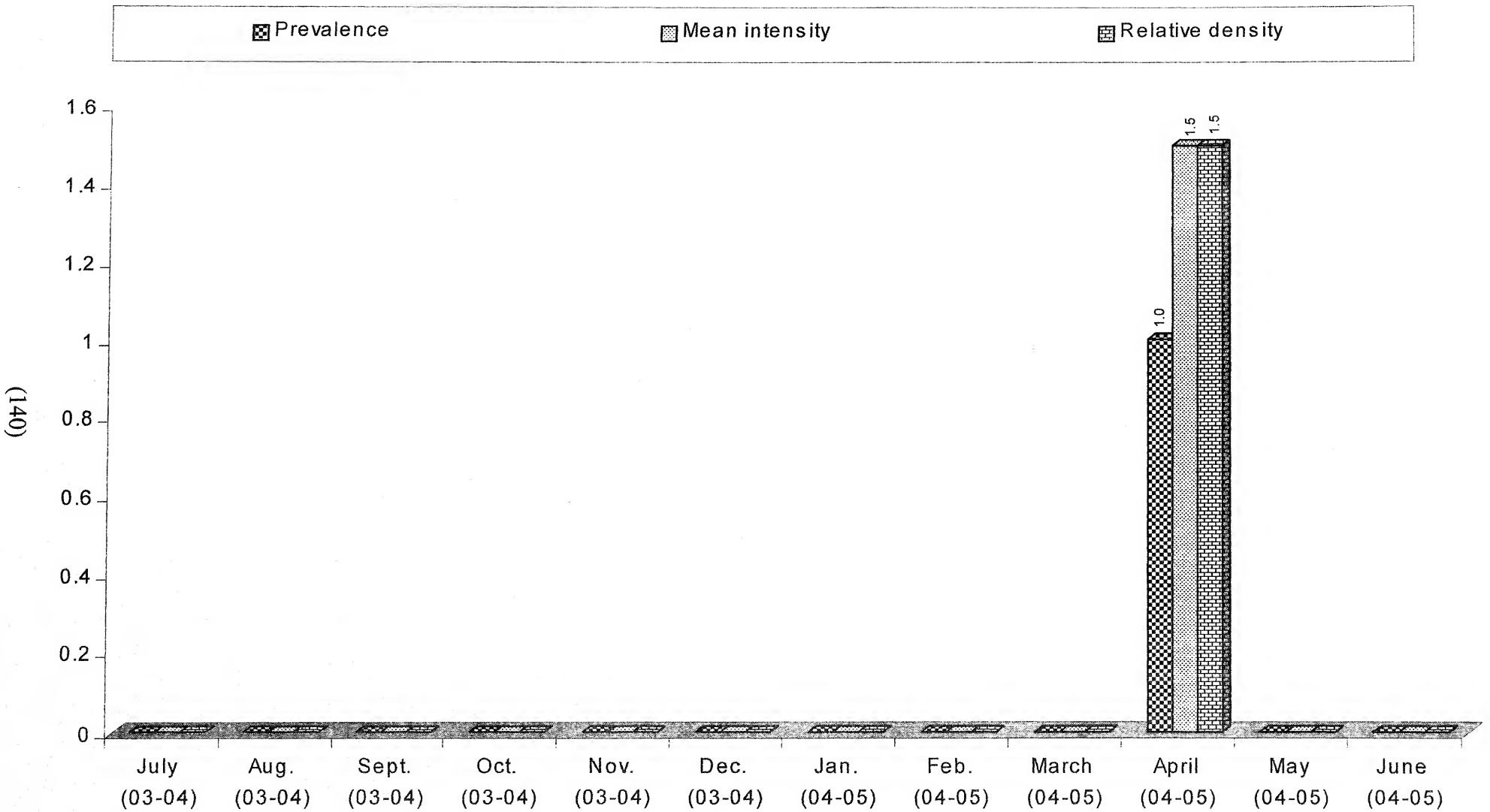

Fig. 30 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the host (351-450 gm.)

II- CESTODE INFECTION IN RELATION TO THE SEX OF THE HOST :-

(a) Average annual variations:- [Table 33 Fig. 31]

(i) Prevalence

The prevalence of cestode infection was 0.156 in males and 0.094 in females.

(ii) Mean intensity

The mean intensity of cestode infection was 1.666 in males and 1.4 in females.

(iii) Relative density

The relative density of cestode infection was 0.261 in males and 0.132 in females.

TABLE 33 : Average annual variations in the prevalence, mean intensity and relative density of cestode infection in relation to the sex of the host

Sex	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Male	134	21	0.156	35	1.666	0.261
Female	106	10	0.094	14	1.4	0.132

II- CESTODE INFECTION IN RELATION TO THE SEX OF THE HOST :-

(a) Average annual variations:- [Table 33 Fig. 31]

(i) Prevalence

The prevalence of cestode infection was 0.156 in males and 0.094 in females.

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The mean intensity of cestode infection was 1.666 in males and 1.4 in females.

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Sex	No. of hosts		Prevalence	Number of ecstodes obtained	Mean intensity	Relative density
	Examined	Infected				
Male	134	21	0.156	35	1.666	0.261
Female	106	10	0.094	14	1.4	0.132

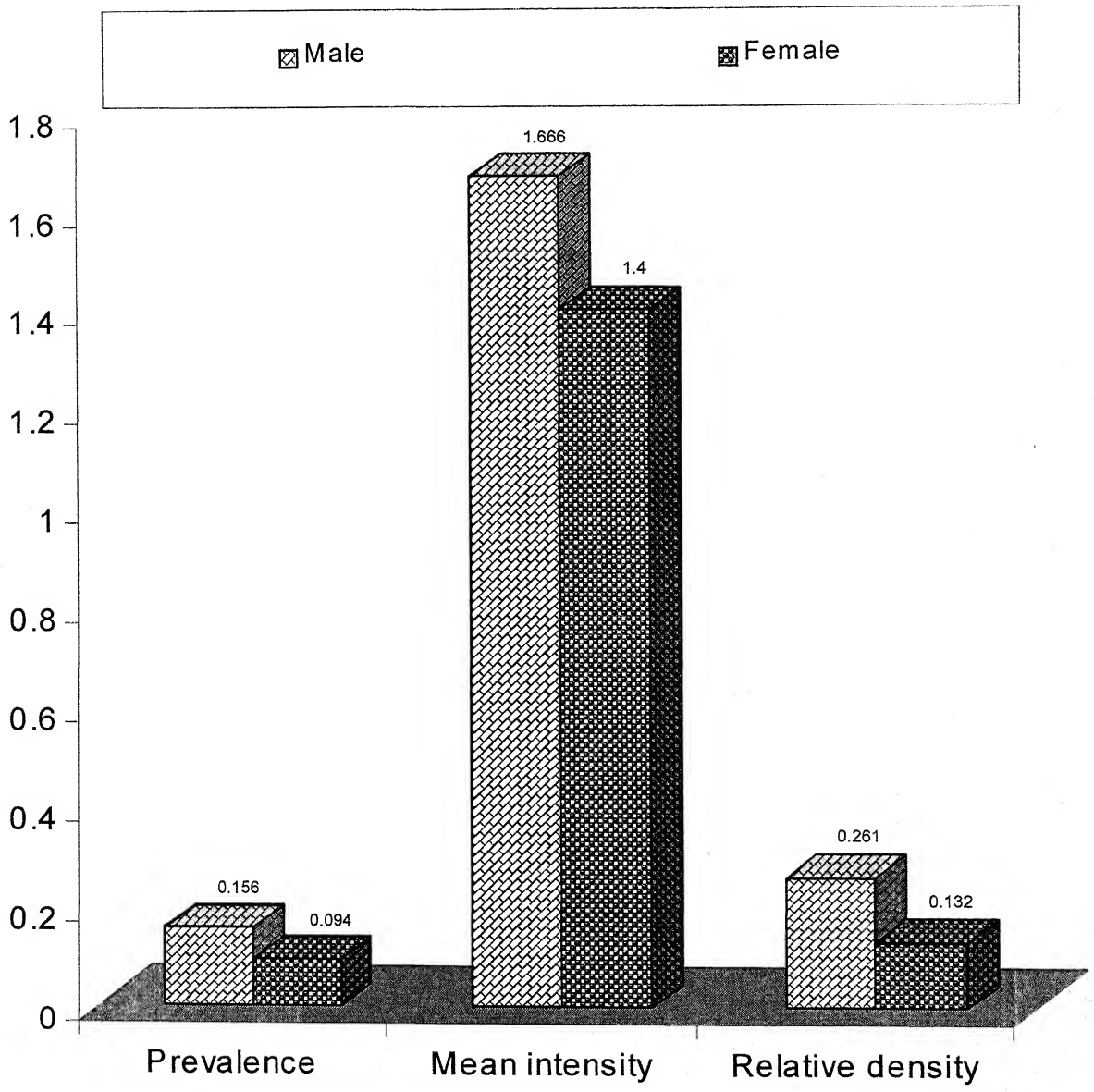

Fig. 31 : Average annual variations in the prevalence, mean intensity and relative density of cestode infection in relation to the sex of the host

(b) Average seasonal variations :-[Tables 34 - 35 Figs. 32 - 33)

(i) Prevalence

IN MALES :-

The maximum prevalence (0.244) was recorded in summer while minimum 0.023 in rainy season.

IN FEMALES :-

The maximum prevalence (0.171) was recorded in summer while minimum (0.029) in winter season.

(ii) Mean intensity

IN MALES :-

The maximum mean intensity (2.0) was recorded in winter while minimum (1.0) in rainy season.

IN FEMALES :-

The maximum mean intensity (1.666) was recorded in summer while minimum (1.0) in rainy and winter seasons.

(iii) Relative density

IN MALES :-

The maximum relative density (0.391) was recorded in winter while minimum (0.023) in rainy season.

IN FEMALES :-

The maximum relative density (0.285) was recorded in summer while minimum (0.029) in winter season.

TABLE 34 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the male host

Season	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Rainy	43	1	0.023	1	1.0	0.023
Winter	46	9	0.195	18	2.0	0.391
Summer	45	11	0.244	16	1.456	0.355

TABLE 35 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the female host

Season	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Rainy	37	3	0.081	3	1.0	0.081
Winter	34	1	0.029	1	1.0	0.029
Summer	35	6	0.171	10	1.666	0.285

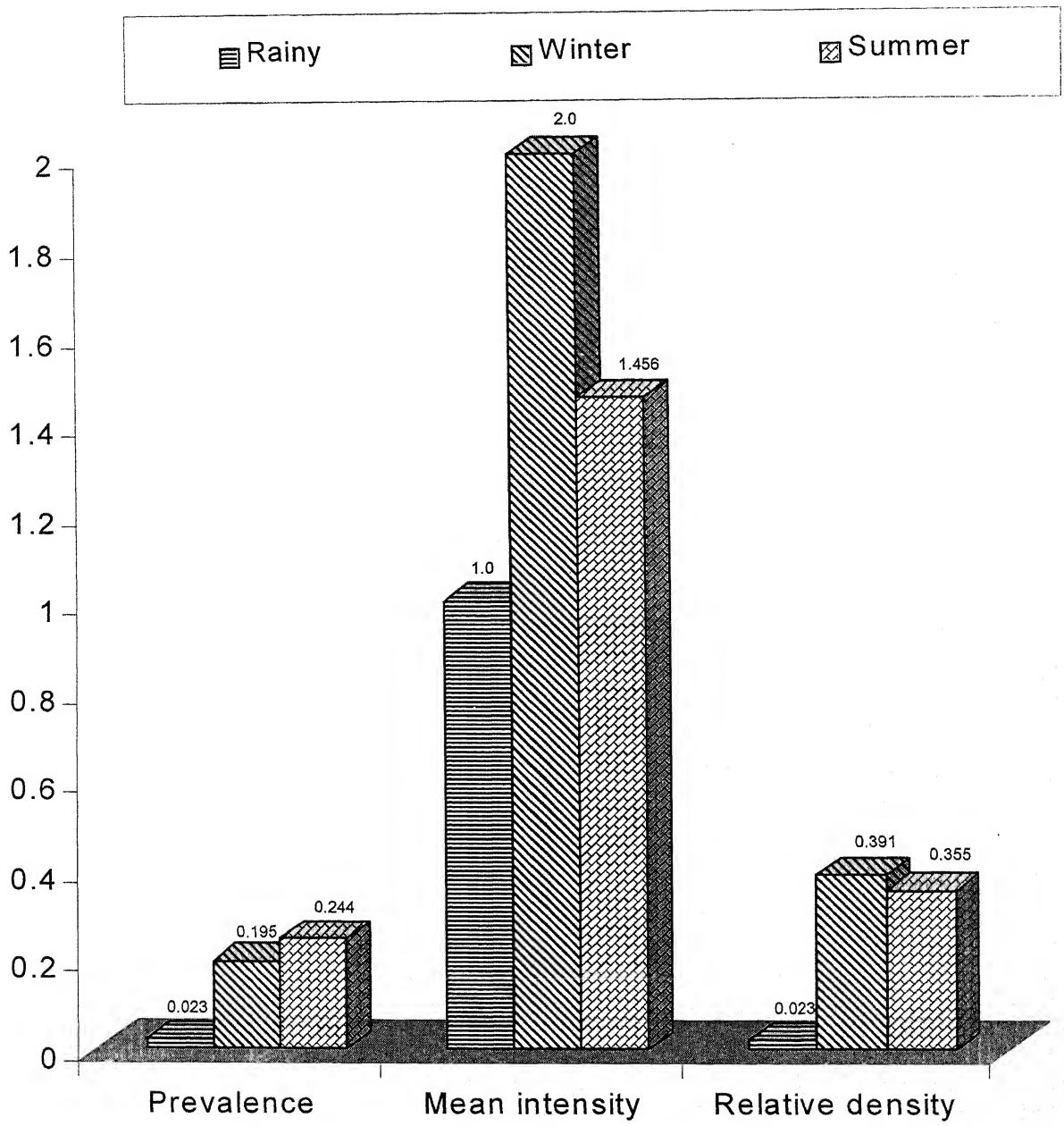

Fig. 32 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the male host

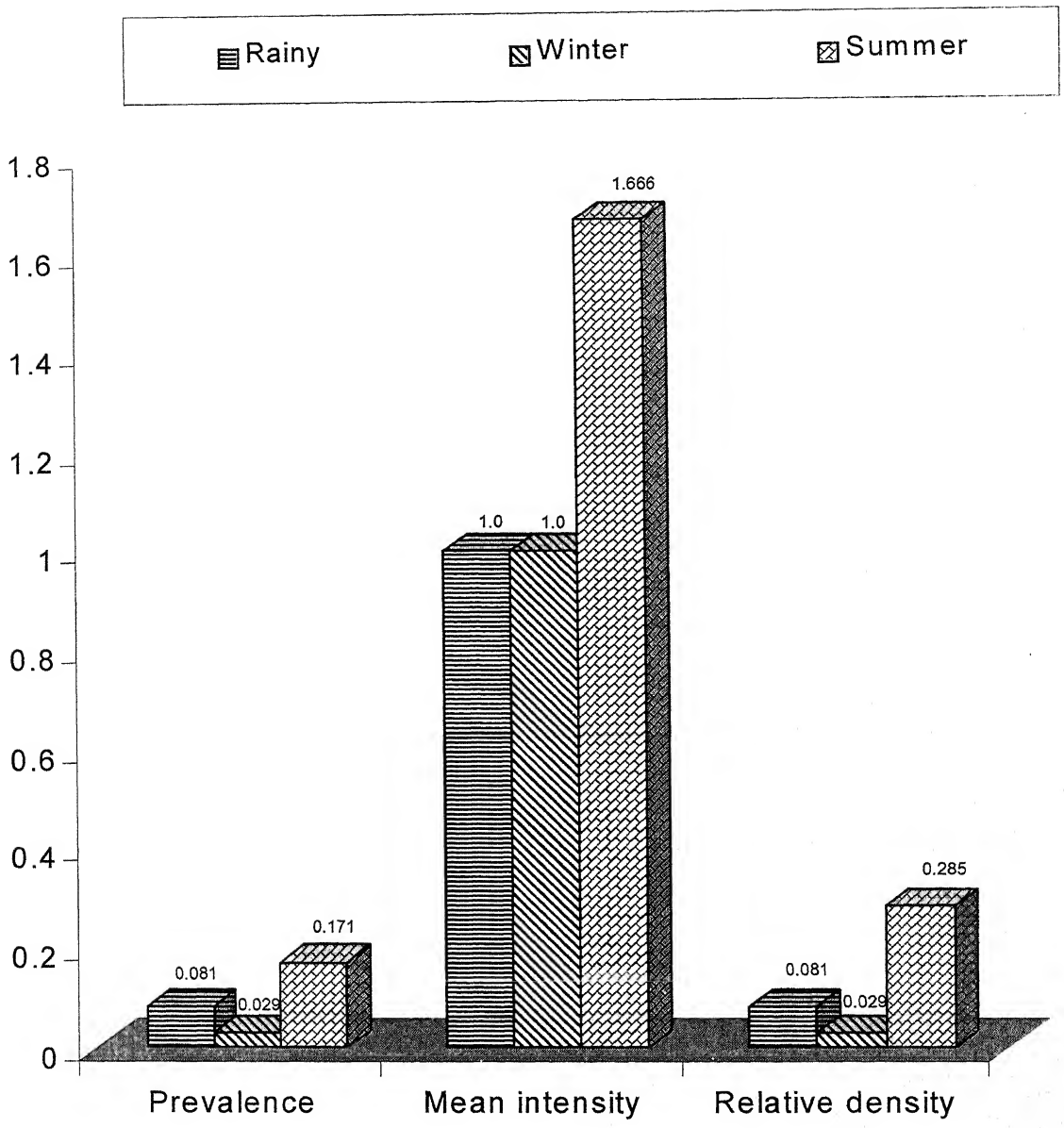

Fig. 33 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the female host

(C) Average monthwise variations :-

IN MALES (Table 36, Fig. 34) :-

(i) Prevalence

The maximum prevalence (0.416) was recorded in February while minimum (O) in August, September, October, December and January. In rest of the months it ranges from 0.090 to 0.357.

(ii) Mean intensity

The maximum mean intensity (2.75) was recorded in the month of November where as minimum (O) in August, September, October, December and January. In rest of the months it ranges from 1.0 to 1.8.

(iii) Relative density

The maximum relative density (1.0) was recorded in the month of November while minimum (O) in August, September, October, December and January. In rest of the months it ranges from 0.090 to 0.642.

Table 36 : Average monthwise variations in the Prevalence, mean intensity and relative density of cestode infection in relation to the male host

Month/ Years	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
July (03-04)	9	1	0.111	1	1.0	0.111
Aug. (03-04)	10	0	0	0	0	0
Sept. (03-04)	10	0	0	0	0	0
Oct. (03-04)	14	0	0	0	0	0
Nov. (03-04)	11	4	0.363	11	2.75	1.0
Dec. (03-04)	10	0	0	0	0	0
Jan. (04-05)	13	0	0	0	0	0
Feb. (04-05)	12	5	0.416	7	1.4	0.583
March (04-05)	9	2	0.222	3	1.5	0.333
April (04-05)	14	5	0.357	9	1.8	0.642
May (04-05)	11	3	0.272	3	1.0	0.272
June (04-05)	11	1	0.090	1	1.0	0.090

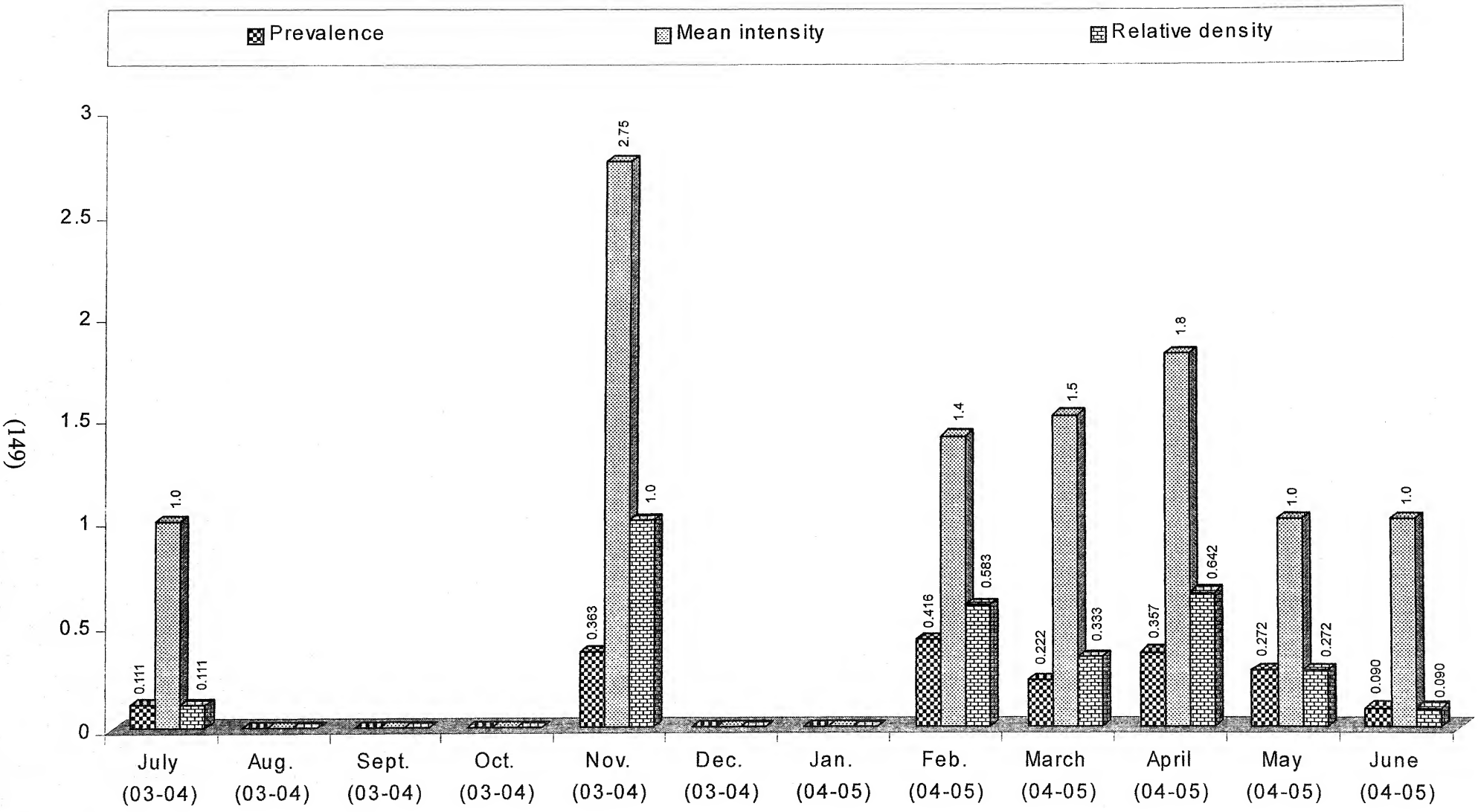

Fig. 34 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the male host

IN FEMALES (Table 37, Fig. 35) :-

(i) Prevalence

The maximum prevalence (0.333) was recorded in October and April while minimum (O) in August, September, December, January and February. In rest of the months it ranges from 0.090 to 0.181.

(ii) Mean intensity

The maximum mean intensity (2.0) was recorded in the months of April, May and June. while minimum (O) in August, September, December, January and February. In rest of the months it was (1.0).

(iii) Relative density

The maximum relative density (0.666) was recorded in April while minimum (O) in August, September, December, January and February. In rest of the months it ranges from 0.090 to 0.333.

Table 37 : Average monthwise variations in the Prevalence, mean intensity and relative density of cestode infection in relation to the female host

Month/ Years	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
July (03-04)	11	1	0.090	1	1.0	0.090
Aug. (03-04)	10	0	0	0	0	0
Sept. (03-04)	10	0	0	0	0	0
Oct. (03-04)	6	2	0.333	2	1.0	0.333
Nov. (03-04)	9	1	0.111	1	1.0	0.111
Dec. (03-04)	10	0	0	0	0	0
Jan. (04-05)	7	0	0	0	0	0
Feb. (04-05)	8	0	0	0	0	0
March (04-05)	11	2	0.181	2	1.0	0.181
April (04-05)	6	2	0.333	4	2.0	0.666
May (04-05)	9	1	0.111	2	2.0	0.222
June (04-05)	9	1	0.111	2	2.0	0.222

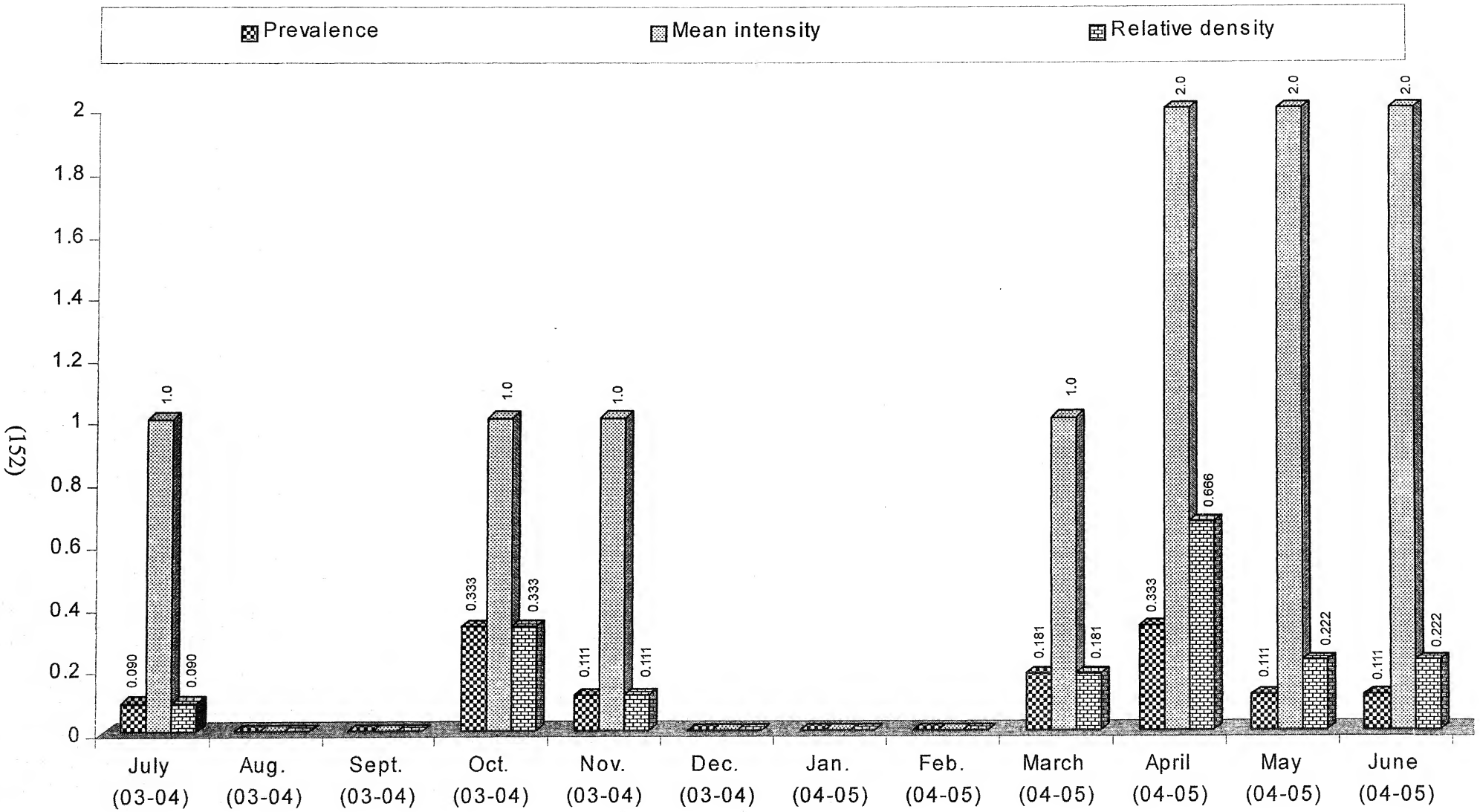

Fig. 35 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the female host

III- CESTODE INFECTION IN RELATION TO THE CLOACAL TEMPERATURE OF THE HOST :-

(a) Average annual variations [Table 38 Fig. 36] :-

(i) Prevalence

The maximum prevalence of cestode infection (0.23) was recorded in the host ranging from 26-31^{0}C cloacal temperature while minimum (O) in the host cloacal temperature ranging 20-25^{0}C.

(ii) Mean intensity

The maximum mean intensity of cestode infection (1.695) was recorded in the host ranging from 26-31^{0}C cloacal temperature while minimum (O) was recorded in the host ranging from 20-25^{0}C.

(iii) Relative density

The maximum relative density of cestode infection (0.39) was recorded in the host ranging from 26-31^{0}C while minimum (O) in the host ranging from 20-25^{0}C.

TABLE 38 : Average annual variations in the prevalence, Mean intensity and relative density of cestode infection in relation to the cloacal temperature of the host

Cloacal temperature ^{0}C	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
20-25	40	0	0	0	0	0
26-31	100	23	0.23	39	1.695	0.39
32-37	100	8	0.08	10	1.25	0.1

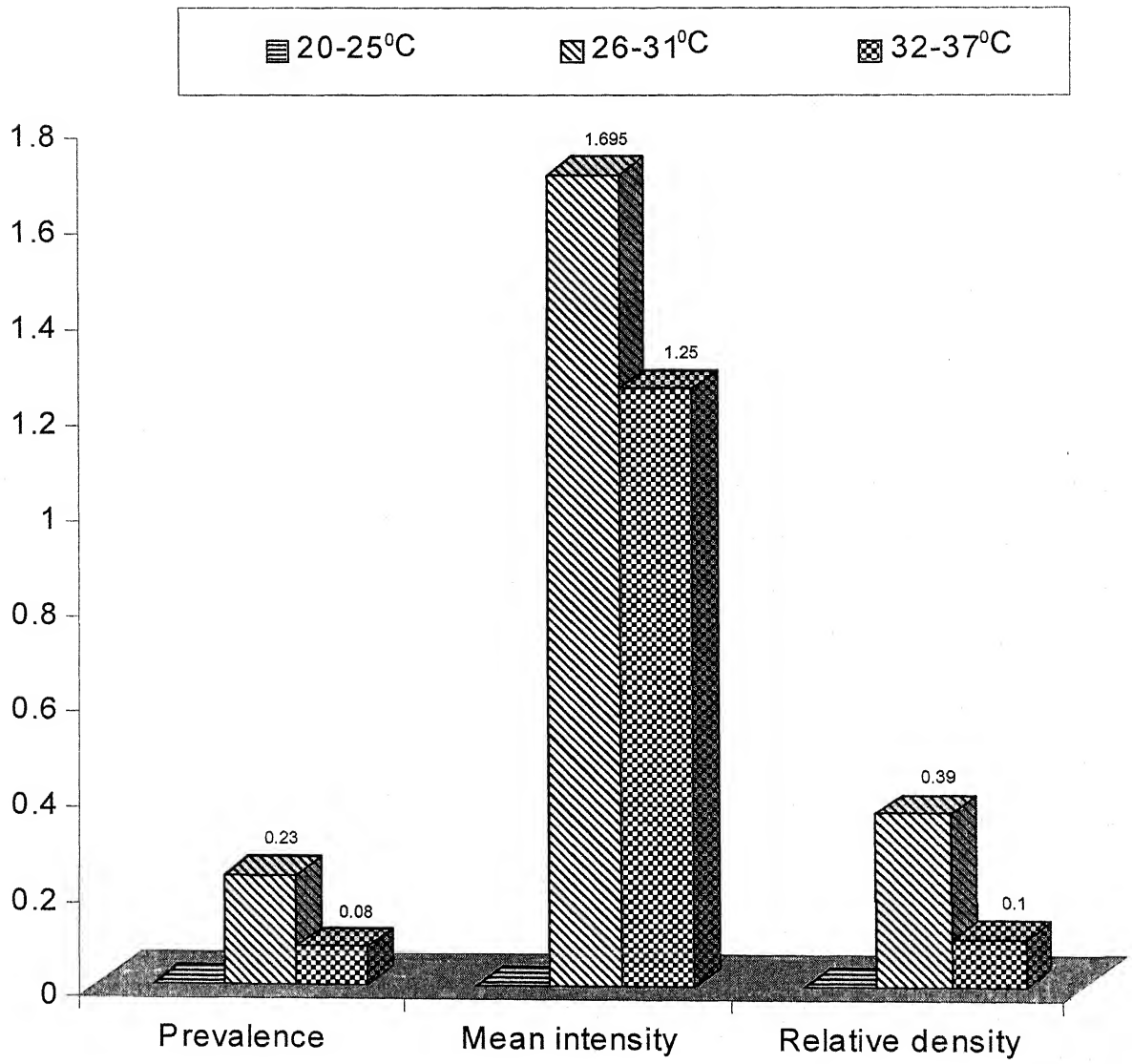

Fig. 36 : Average annual variations in the prevalence, mean intensity and relative density of cestode infection in relation to the cloacal temperature of the host

(b) Average seasonal variations (Tables 39-41, Figs. 37-38) :-

(i) Prevalence

The maximum prevalence (0.275) was recorded in the host cloacal temperature ranging from 26-31^{0}C in summer season.

The minimum prevalence (O) was recorded in the host cloacal temperature ranging from 20-25^{0}C in winter season. Cloacal temperature ranging from 20-25^{0}C in rainy and summer seasons and 32-37^{0}C in winter season could not be studied because fishes belongs to poikelothermic group.

(ii) Mean intensity

The maximum mean intensity (1.9) was recorded in the host cloacal temperature ranging 26-31^{0}C in winter season.

The minimum mean intensity (O) was recorded in the host cloacal temperature ranging from 20-25^{0}C in winter season. Cloacal temperature ranging from 20-25^{0}C in rainy and summer seasons and 32-37^{0}C in winter season could not be studied because fishes belongs to poikelothermic group.

(iii) Relative density

The maximum relative density (0.475) was recorded in the host cloacal temperature ranging from 26-31^{0}C in winter.

The minimum relative density (O) was recorded in the host cloacal temperature ranging from 20-25^{0}C in winter. Cloacal temperature ranging from 20-25^{0}C in rainy and summer seasons and 32-37^{0}C in winter season could not be studied because fishes belongs to poikelothermic group.

TABLE 39 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the cloacal temperature of the host (20-25°C)

Season	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Rainy	-	-	-	-	-	-
Winter	40	0	0	0	0	0
Summer	-	-	-	-	-	-

TABLE 40 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the cloacal temperature of the host (26-31°C)

Season	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Rainy	20	2	0.1	2	1.0	0.1
Winter	40	10	0.25	19	1.9	0.475
Summer	40	11	0.275	18	1.636	0.45

TABLE 41 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the cloacal temperature of the host (32-37°C)

Season	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Rainy	60	2	0.033	2	1.0	0.033
Winter	-	-	-	-	-	-
Summer	40	6	0.15	8	1.333	0.2

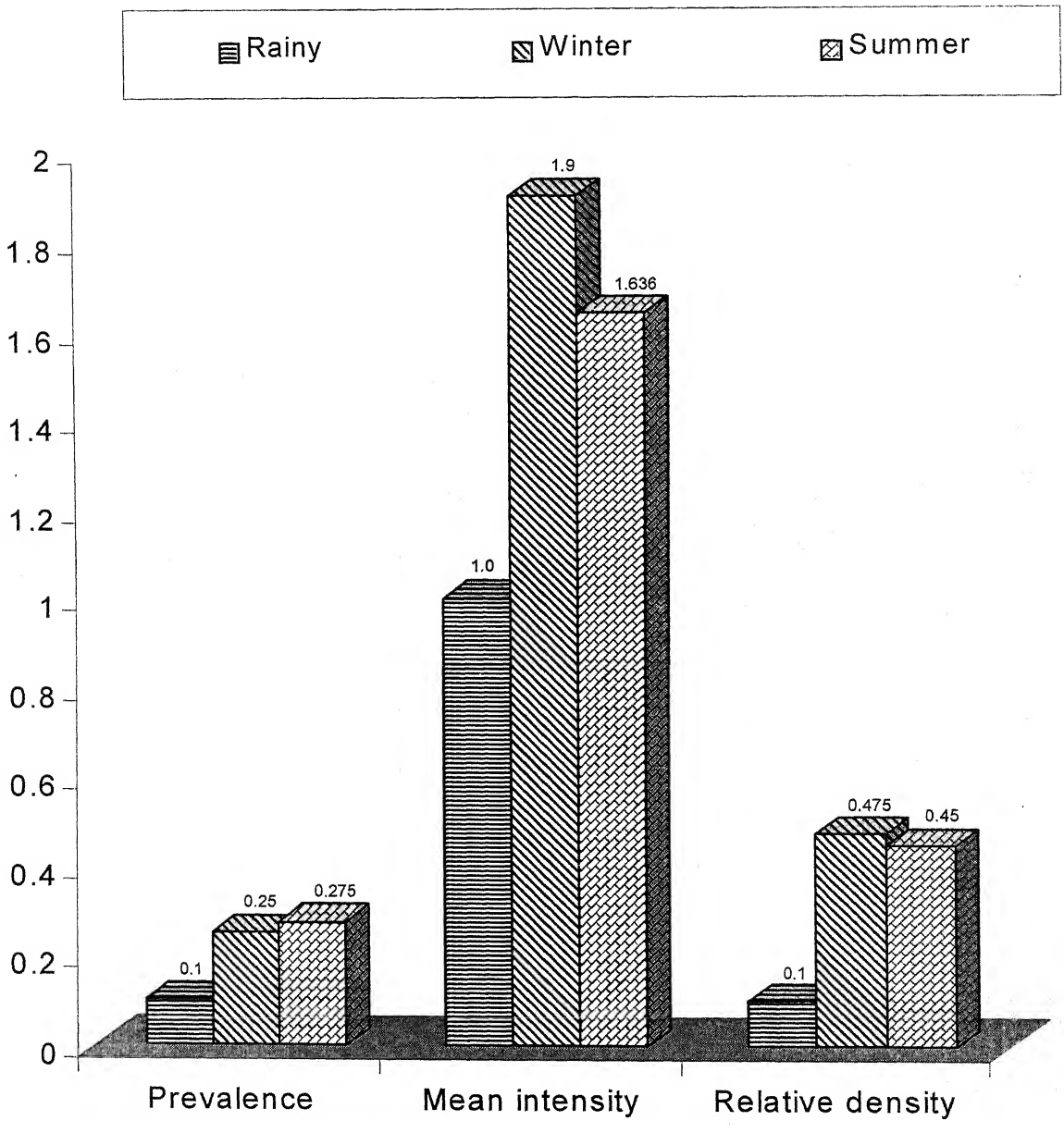

Fig. 37 : Average seasonal variations in the prevalence, mean intensity and relative density of cestodeinfection in relation to the cloacal temperature of the host (26-31°C)

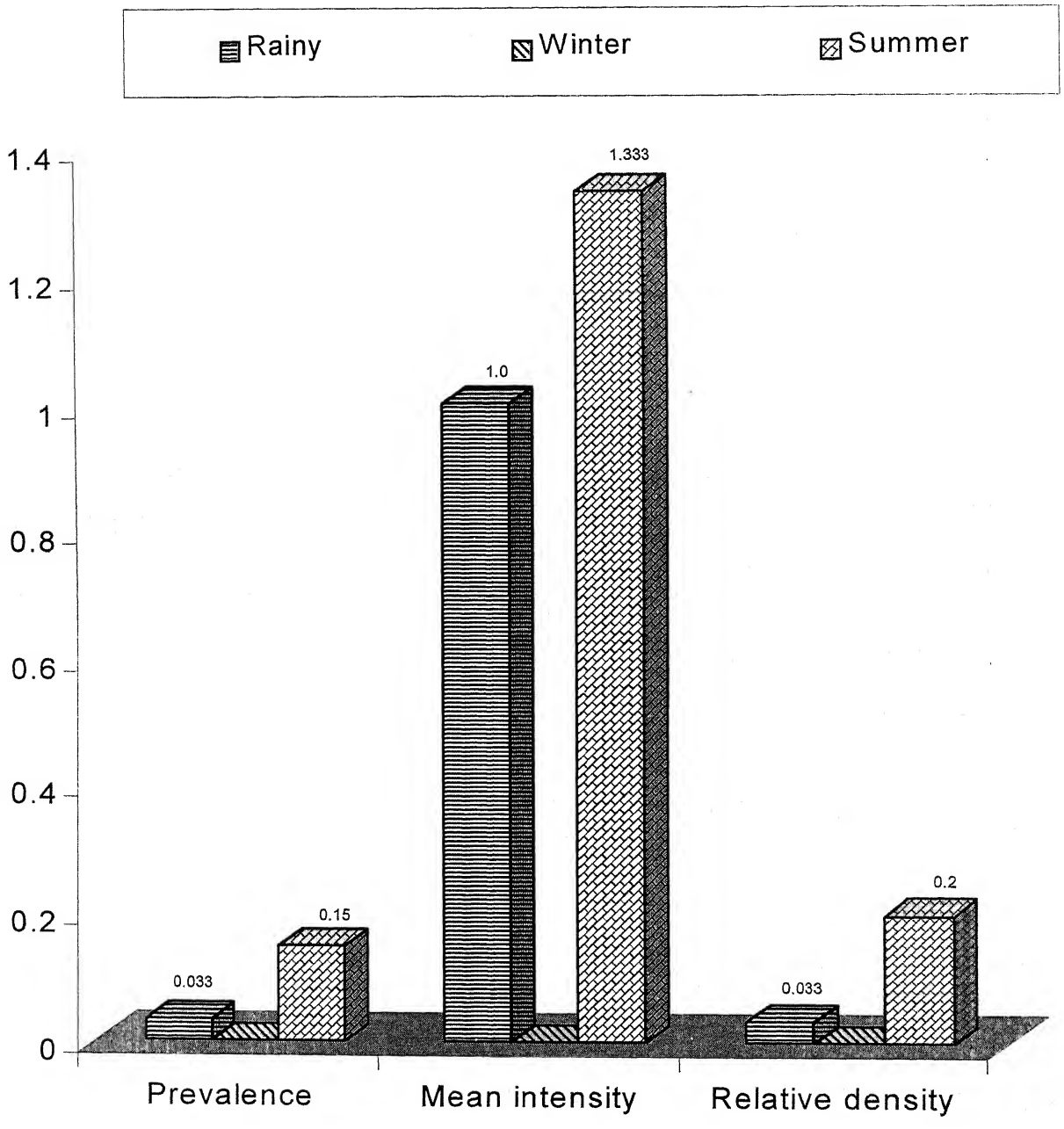

Fig. 38 : Average seasonal variations in the prevalence, mean intensity and relative density of cestode infection in relation to the cloacal temperature of the host (32-37°C)

C- Average monthwise variations (Tables 42-44, Figs. 39-40) :-

(i) Prevalence

Fishes having 20-25°C cloacal temperature showed no infection. This temperature could not be persist in July, August, September, October, November, February, March, April, May and June.

In the host having cloacal temperature ranging from 26-31°C the maximum prevalence (0.35) was recorded in the month of April while minimum (0.1) was recorded in the month of October. In the months of July, August, September, December, January, May and June this temperature could not persist.

In the host having cloacal temperature ranging from 32-37°C the maximum prevalence (0.2) was recorded in the month of May while minimum (O) in the months of August and September. This temperature could not persist in October, November, December, January, February, March and April.

(ii) Mean intensity

Fishes having 20-25°C cloacal temperature showed no infection. This temperature could not persist in July, August, September, October, November, February, March, April, May and June.

In the host having cloacal temeprature ranging from 26-31°C the maximum mean intensity (2.4) was recorded in the month of November while minimum (1.0) in October. This temperature could not persist in July, August, September, December, January, May and June.

In the host having cloacal temperature ranging from 32-37°C the maximum mean intensity (1.5) was recorded in the month of June while

minimum (O) in August and September. This temperature could not persist in October, November, December, January, February, March and April.

(iii) Relative density

Fishes having cloacal temperature 20-25^{0}C showed no infection. This range could not persist in July, August, September, October, November, February, March, April, May and June.

The cloacal temperature ranging from 26-31^{0}C showed maximum relative density (0.65) in the month of April while minimum (0.1) in October. This temperature range could not persist in July, August, September, December, January, May and June.

In the host having cloacal temperature ranging from 32-37^{0}C showed maximum relative density (0.25) in the month of may while minimum (O) in August and September. This temperature range could not persist in October, November, December, January, February, March and April.

TABLE 42 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the cloacal temperature of the host (20-25°C)

Month/ Years	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
July (03-04)	-	-	-	-	-	-
Aug. (03-04)	-	-	-	-	-	-
Sept. (03-04)	-	-	-	-	-	-
Oct. (03-04)	-	-	-	-	-	-
Nov. (03-04)	-	-	-	-	-	-
Dec. (03-04)	20	0	0	0	0	0
Jan. (04-05)	20	0	0	0	0	0
Feb. (04-05)	-	-	-	-	-	-
March (04-05)	-	-	-	-	-	-
April (04-05)	-	-	-	-	-	-
May (04-05)	-	-	-	-	-	-
June (04-05)	-	-	-	-	-	-

TABLE 43 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the cloacal temperature of the host (26-31°C)

Month/ Years	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
July (03-04)	-	-	-	-	-	-
Aug (03-04)	-	-	-	-	-	-
Sept. (03-04)	-	-	-	-	-	-
Oct. (03-04)	20	2	0.1	2	1.0	0.1
Nov. (03-04)	20	5	0.25	12	2.4	0.6
Dec. (03-04)	-	-	-	-	-	-
Jan. (04-05)	-	-	-	-	-	-
Feb. (04-05)	20	5	0.25	7	1.4	0.35
March (04-05)	20	4	0.2	5	1.25	0.25
April (04-05)	20	7	0.35	13	1.857	0.65
May (04-05)	-	-	-	-	-	-
June (04-05)	-	-	-	-	-	-

TABLE 44 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the cloacal temperature of the host (32-37°C)

Month/ Years	No. of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
July (03-04)	20	2	0.1	2	1.0	0.1
Aug. (03-04)	20	0	0	0	0	0
Sept. (03-04)	20	0	0	0	0	0
Oct. (03-04)	-	-	-	-	-	-
Nov. (03-04)	-	-	-	-	-	-
Dec. (03-04)	-	-	-	-	-	-
Jan. (04-05)	-	-	-	-	-	-
Feb. (04-05)	-	-	-	-	-	-
March (04-05)	-	-	-	-	-	-
April (04-05)	-	-	-	-	-	-
May (04-05)	20	4	0.2	5	1.25	0.25
June (04-05)	20	2	0.1	3	1.5	0.15

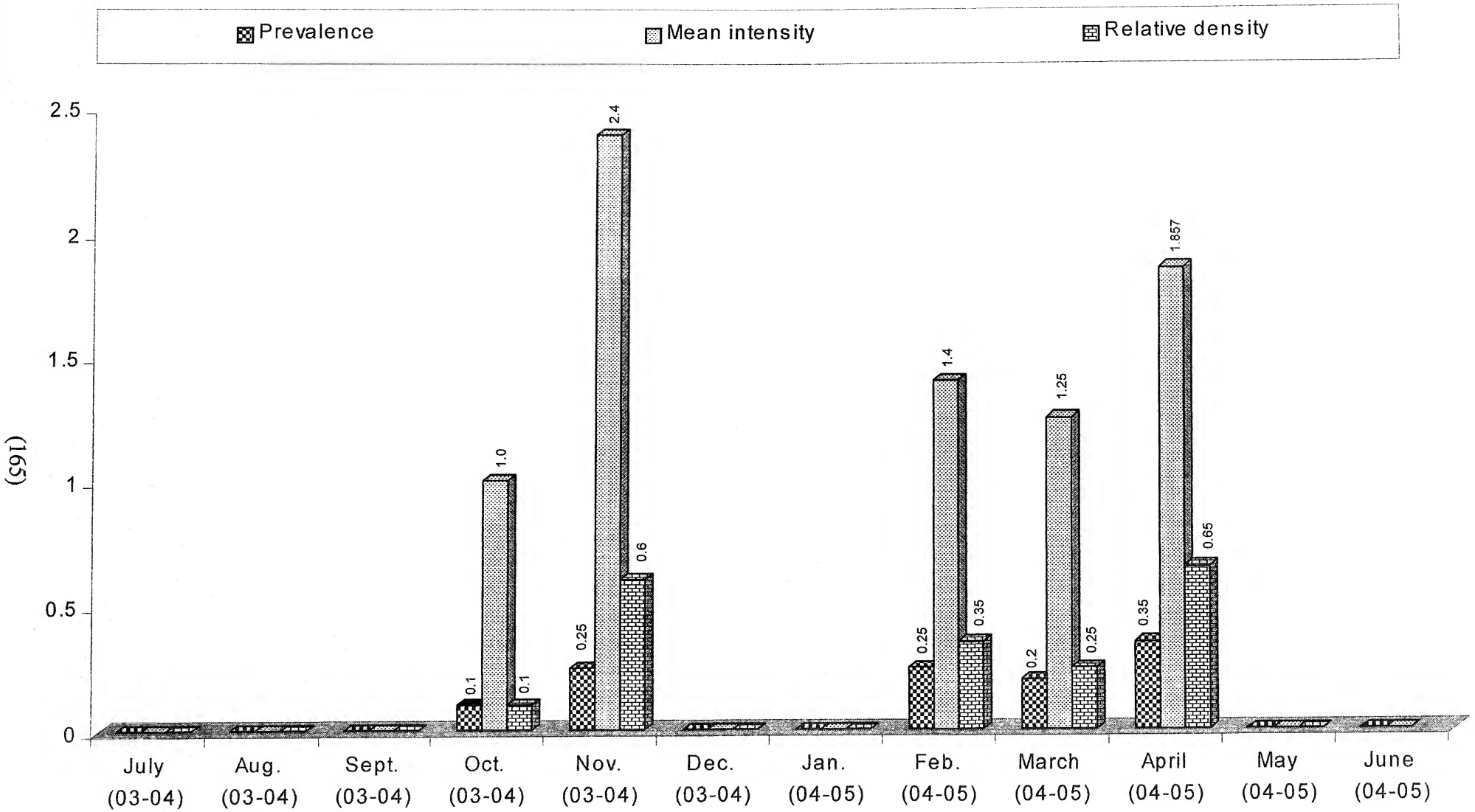

Fig. 39 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the cloacal temperature of the host (26-31^{0}C)

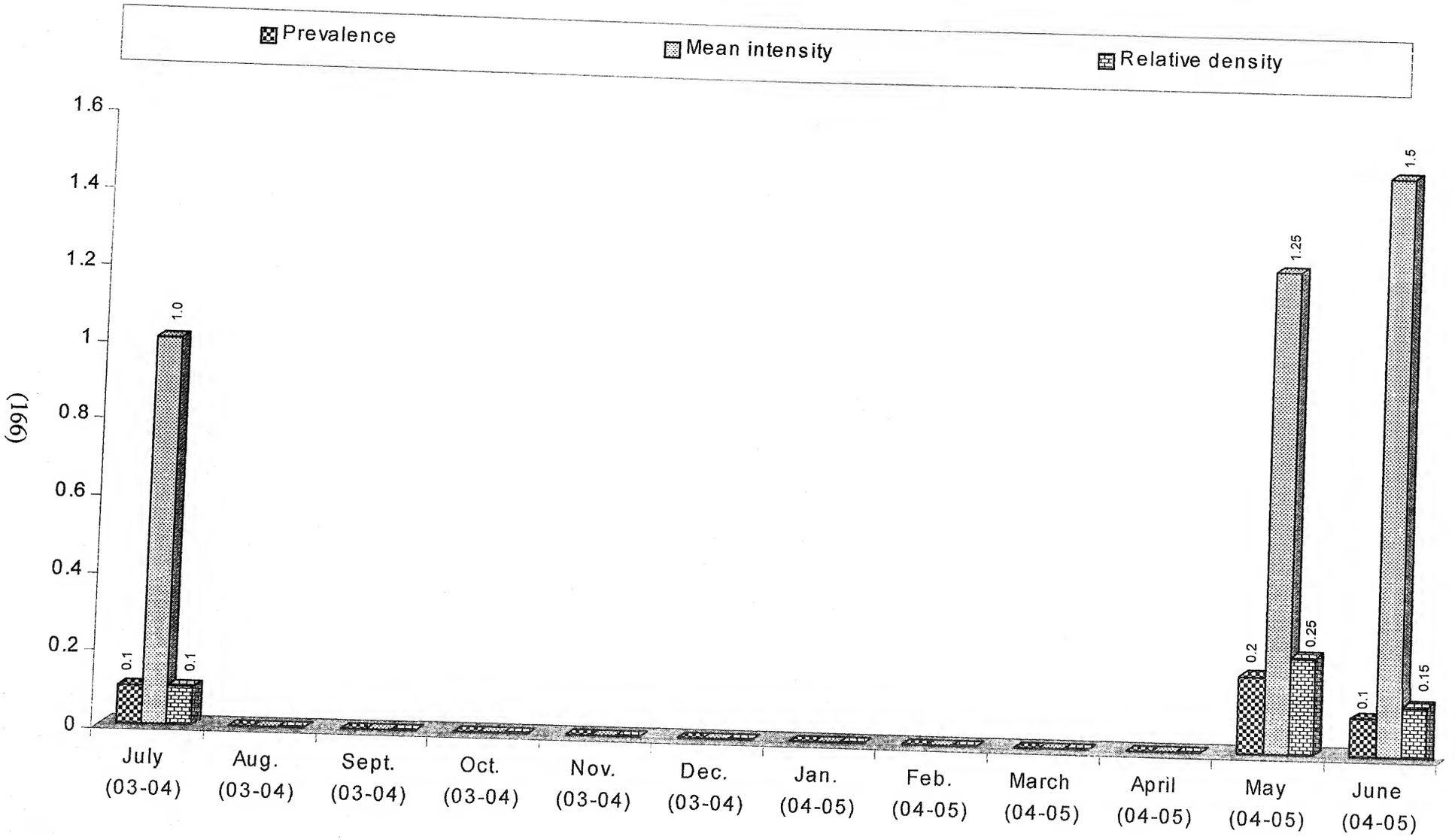

Fig. 40 : Average monthwise variations in the prevalence, mean intensity and relative density of cestode infection in relation to the cloacal temperature of the host (32-37°C)

DISCUSSION AND CONCLUSION

The monthly ecological observations of *Mastacembelus armatus* (Lacepede) for two successive years, reveal that they were generally infested with helminth parasites Viz. trematodes, cestodes, nematodes and acanthocephala.

During the course of present investigation in *Mastacembelus armatus* (Lacepede) however, it was noted that nematodes constitute the dominant group of helminth parasites, in their annual prevalence, mean intensity and relative density over the trematodes, cestodes and acanthocephala infection (Table 21, Fig. 19) but cestodes show second dominant group of helminth parasites, in their annual prevalence, mean intensity and relative density over the trematodes and acanthocephala infection (Table 21, Fig. 19). Similarly acanthocephala show third dominant group of helminth parasites, in their annual prevalence, mean intensity and relative density over the trematodes infection (Table 21, Fig. 19).

Malhotra, Chauhan and Capoor (1980) reported that the dominance of nematodes infection over the cestodes and trematodes infection in marine fishes. Mathur and Srivastav (1998) reported the dominance of cestodes infection in *Heteropneustes fossilis* (Bl.) over trematodes infection. Srivastav and Khare (1998) reported that the rate of infection of tapeworms is mostly greater in the fishes of Bundelkhand region of Uttar Pradesh. Lohia (2000) reported that the dominace of acanthocephala infection over the trematodes infection in *Channa punctatus* (Bl.). Pathak (2002) reported that the dominance of nematodes infection over the cestodes infection in *Rita rita* (Ham.).

Since, in the present project the author has restricted himself to the cestodes parasites only therefore, on the basis of above discussion it can be concluded that the fish *Mastacembelus armatus* (Lacepede) in Betwa river, district Jhansi (U.P.) India have moderate immunity against cestodes infestation.

The prevalence and relative density of cestodes infection in *Mastacembelus armatus* (Lacepede) have been found highest during summer season, moderate during winter season and lowest during rainy season while the mean intensity to be highest during winter season, moderate during summer season and lowest during rainy season. Similarly highest monthly prevalence and relative density have been found in April while mean intensity to be highest in November.

This phenomenon may be related to the relative incidence of the intermediate hosts of these parasites. The food of *Mastacembelus armatus* (Lacepede) comprised of molluscs, crustaceans and their larvae, insects and their larvae etc. and acts as intermediate hosts which is affected by seasonal and monthwise variations. Markov and Rogoza (1955) reported that greater helminths infection occurred in spring season. Less (1962) reported that the highest incidence of parasitization by helminths occurred in the autumn season in united Kingdom, where insects and other arthropods reappear after winter diapause with the maximum in spring i.e. helminth abundance follows intermediate host abundance. Kinsella (1966) reported that parasitic prevalence during summer and rainy seasons and believes that the greater occurrence of arthropods in these seasons is the sole reason for their prevalence. From the available reports thus a strong indication exists that there is a definite correlation between the

occurrence of the parasites and their intermediate hosts during the year. Mathur (1992) reported that the highest prevalence, mean intensity and relative density of cestodes infection during summer season. Lohia (2000) reported that the highest prevalence, mean intensity and relative density during summer season while lowest in rainy season. Pathak (2002) reported that the highest prevalence and relative density during summer season while highest mean intensity during rainy season. Singh and Malik (2004) reported that the infection percentage increased rapidly from spring to summer season. On the basis of above discussion it can be concluded that the fish, *Mastacembelus armatus* (Lacepede) in Betwa river, district, Jhansi (U.P.) India have lowest immunity during first half of the summer and winter seasons, moderate during second half of summer and winter seasons and highest during rainy season.

CESTODE INFECTION AND BODY WEIGHT OF THE HOST

The body weight of the host is related to the number of factors like age, health, length and availability of food. The present observations indicate that the fish of first intermediate body weight (151-250 gm.) shows highest, annual prevalence, mean intensity and relative density of cestodes infection. The fish of second intermediate body weight (251-350 gm.), shows moderate annual prevalence, mean intensity and relative density of cestodes infection whereas the fish of lower body weight (51-150 gm.) and higher body weight (351-450 gm.) shows lowest annual prevalence, mean intensity and relative density of cestodes infection (Table 24, Fig. 22). Eure (1976) has reported that intermediate sized fishes have highest intensity of infection. Chauhan, Malhotra and Capoor (1981) reported that the highest cestodes infected fishes in age group between one to four years. Amin (1986)

reported that a modest increase in worms burden by host size, which however, become reversed in the largest males and females. He further mentioned that the decreased worms bunden in largest fishes may have been caused be age and related factors such as changes in feeding habits.

Jha and Sinha (1990) reported that the higher prevalence and intensity of acanthocephala occurrence in middle length groups and comparatively lower occurrence in lower and higher groups of C*hanna punctatus*. Mathur (1992) reported that fish of intermediate body weight shows greater annual prevalence and relative density of cestodes infection in *Heteropneustes fossilis* (Bl.) Lohia (2000) also reported in *Channa punctatus* (Bl.) that the fish of intermediate body weight shows greater annual prevalence and relative density of cestodes infection. Similarly Pathak (2002) also reported that the fish *Rita rita* (Ham.) of intermediate body weight shows greater annual prevalence and relative density of cestodes infection. Singh and Malik (2004) reported that medium sized fishes were found heavily infected while small fishes mostly found free from infection. Oniye, Adebote and Ayanda (2004) also reported that the fish, C*larias gariepinus* (Teugels) of intermediate body weight have maximum prevalence of helminth infection while the fish light in weight found free of infection. On the basis of above discussion it can be concluded that the fish, *Mastacembelus armatus* (Lacepede) of intermediate body weight has more favourable conditions like nutritional richness etc. for cestode parasites infection.

CESTODE INFECTION AND SEX OF THE HOST

In the present observations male fishes show higher annual prevalence, mean intensity and relative density of cestodes infection than the female fishes (Table 33, Fig. 31). Srivastav (2003) reported that male *Hemidactylus flaviviridis* shows higher annual prevalence and relative density of cestodes infection than the female hosts. Klein (2004) reported that the prevalence and intensity of infections caused by protozoa, nematodes, treamatodes, cestodes and arthropods is higher in males than females. According to Klein (2004) immunalogical differences exist between the sexes that may underline increased parasitism in males compared to females. He also reported that the female sex hormones estrogens increase the formation of interferons and other immunological factors which increase resistance in females, while male sex hormone testosterone reduces antibody production which decreased resistance in males. On the basis of above discussion it can be concluded that due to changes in endocrine–immune interactions males *Mastacembelus armatus* (Lacepede) are more susceptible to cestodes infection than females.

CESTODE INFECTION AND CLOACAL TEMPERATURE OF THE HOST

The present observations *Mastacembelus armatus* (Lacepede) shows annual prevalence, mean intensity and relative density of cestode infection highest at 26 – 31^{0}C and lowest at 32- 37^{0}C body temperature respectively. The fishes at 20-25^{0}C body temperature have no infection of cestode parasites (Table 38, Fig. 36).

According to Chubb (1977) the temperature affects egg production, larval development, maturation and worm survival in

many fish monogeneans, thus controlling seasonal population cycles. Esch (1983) reported that in many cestodes, temperature is the single most important factor influencing seasonal cycles, either directly, affecting recruitment and mortality as indirectly, affecting host immune responses and predator–prey interaction between final and intermediate hosts. The present observation also supports Tachque and Tinsley (1991) interpretation that maximum growth occurred at 29^{0}C and decline above 32^{0}C and below 22^{0}C. Mathur and Srivastav (1999) reported that higher annual prevalence, mean intersity and relative density of cestodes infection in fresh water fish, *Heteropneustes fossilis* (Bl.) occurred at 25.5 –29.4^{0}C body temperature. Lohia (2000) reported that higher annual prevalence of cestodes infection occurred at 24.4-26.6^{0}C body temperature in fresh water fish, *Channa punctatus* (Bl.). Pathak (2002) also reported that higher annual prevalence, mean intensity and relative density of cestodes infection occurred at 26-32^{0}C body temperature in fresh water fish, *Rita rita* (Ham.). On the basis of above discussion it can be concluded that the body temperature ranges from 26^{0}C to 31^{0}C in *Mastacembelus armatus* (Lacepede) provides more favourable conditions for cestodes infection.

Part-D

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